MOTOROLA

LINK RECEIVER OPTIONS

C661____ Option Series

659-660-662-663

Instruction Manual

68P81063E10-O

COMMERCIAL WARRANTY
(STANDARD)

Motorola radio communications products are warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR, (except for crystals and channel elements which are warranted for a period of ten (10) years) from the date of shipment. Parts, including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola Communications and Electronics, Inc., 1301 E. Algonquin Road, Schaumburg, Illinois 60196, to the original purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by seller, or if appropriate, to specifications accepted by Seller in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof, and such action on the part of Motorola shall be the full extent of Motorola's liability hereunder.

This warranty is void if:

a. the product is used in other than its normal and customary manner;
b. the product has been subject to misuse, accident, neglect or damage;
c. unauthorized alterations or repairs have been made, or unapproved parts used in the equipment.

This warranty extends only to individual products, batteries are excluded, but carry their own separate limited warranty. Because each radio system is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty except by a separate written agreement signed by an officer of Motorola.

Non-Motorola manufactured products are excluded from this warranty, but subject to the warranty provided by their manufacturers, a copy of which will be supplied to you on specific written request.

In order to obtain performance of this warranty, purchaser must contact its Motorola salesperson or Motorola at the address first above shown, attention Quality Assurance Department.

This warranty applies only within the United States.

EPS-27734-O

COMPUTER SOFTWARE COPYRIGHTS

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EPS-34440-B

MOTOROLA INC.

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81063E10-O 68P81063E10-A	Link Receiver Options Instruction Manual

REVISION DETAILS:

Locate Section 68P81063E81
Receiver Model TRE1242A (450-470 MHz)

Page 3
At the top of the page under Step 14, in the STAGE and PROCEDURE column, change the 20 dB quieting level to read 1.5 uV or less; and delete ".25 uV with preamplifier".

Page 5
In the left-hand column, under Step 11, change the level to read 1.5 uV or less; and delete the preamplifier references. In the right-hand column, under Step 9, change the level to read 1.5 uV or less; and delete the preamplifier references.

Locate Section 68P81063E26
Receiver Model TRF1032A (900 MHz)

Page 3
In the right-hand column, under Step 8, change the level to read 1.5 uV or less.

PEPS-35633-O
In the TECHNICAL CHARACTERISTICS chart, under SENSITIVITY, change the 20 dB quieting to 1.5 uV; and delete the EIA Sinad reference.

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instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81063E10-A Link Receiver Options Instruction Manual

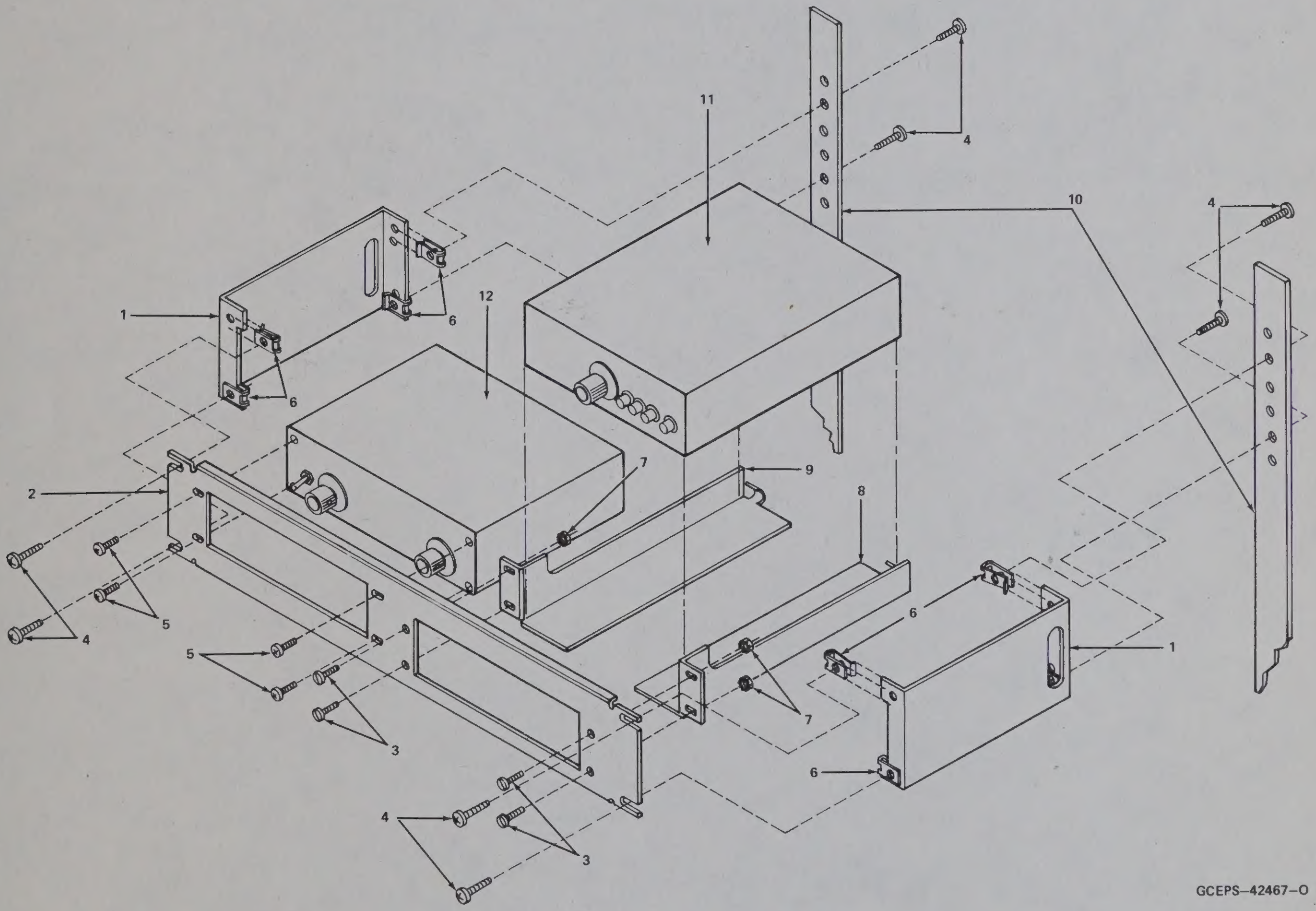
REVISION DETAILS:

A new Model TRN9785A Modem and Delay Line Hardware Kit Instruction Manual, 68P81117E48, is added to the Link Receiver Options Instruction Manual. Refer to the attached Modem and Delay Line Hardware manual as required for installation and parts information.

MOTOROLA INC.
*Communications
Sector*

MODEM AND DELAY LINE HARDWARE

MODEL TRN9785A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GCEPS–42467–O

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technical writing services
1301 E. Algonquin Road, Schaumburg, IL 60196

On Models	Mount Unit in Rack Hole Numbers
C71J2B, C73J2B, C64J2B, B84J2B, B91J2B, B93J2B	3 and 6 from bottom
C75J2B	15 and 18 from bottom
C71J2B with C180 option C73J2B with C180 option C64J2B with C180 option	72 and 75 from top
B91J2B with U27 option B93J2B with U27 option	1 and 4 from bottom
C75J2B with C308	28 and 31 from bottom

parts list

TRN9785A Modem and Delay Line Hardware PL-9843-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	7-83000P01	BRACKET, modem spacer; 2 used
2	64-82616R01	PANEL, front
3	3-7279	SCREW, machine: 8-32 × 5/8"; 4 used
4	3-135038	SCREW, tapping: 1/4-14 × 3/4"; 8 used
5	3-124074	SCREW, machine; 8-32 × 1/2"; 4 used
6	2-84410P04	NUT, stamped; 1/4-14; 6 used
7	2-129892	NUT, hex; 8-32 × 5/16
8	7-82617R01	BRACKET, right half support
9	7-82617R02	BRACKET, left half support
10	—	STATION RACK (for reference only)
11	—	MODEM (for reference only)
12	—	DELAY LINE (for reference only)

Link Receiver Options

C661____ Option Series

68P81063E10-O

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MOTOROLA

AVAILABLE BACKGROUND REFERENCE PUBLICATIONS

Five reference publications are available to provide background information needed to service some of the newer Motorola products more effectively. The information in these publications is not duplicated in our instruction manuals. To obtain your free copy, check the ones you want and return this self-mailer to us. (NOTE: One copy of each publication has already been distributed to Motorola Service Shops (MSS's) and field technical representatives (FTR's).

Check item desired:

☐ **Basic Logic Circuit Guide** 68P81105E88
Describes the basic logic circuits used in Motorola Communications digital equipment and the logic notational scheme used in our instruction manuals.

☐ **"Digital Private-Line" Binary-Coded Squelch** 68P81106E83
Contains fundamentals of "Digital Private-Line" system operation, circuit operation and servicing techniques.

☐ **Safe Handling of CMOS Integrated Circuit Devices** 68P81106E84
Describes special handling techniques needed to prevent irrepairable damage from static charges encountered with normal handling of CMOS devices.

☐ **Reducing Noise Interference in Mobile Two- Way Radio Installations** 68P81109E33
Defines the major sources of noise encountered in a mobile radio installation and suggests methods of remedying them.

☐ **Anti-Skid Braking Precautions** 68P81109E34
Provides installation suggestions and a detailed checkout procedure for installation of mobile radios in vehicles with anti-skid braking systems.

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68P81028E93-G

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PARTS LIST

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2. ☐ Would like more information as follows*

ILLUSTRATIONS IN GENERAL

1. ☐ Are complete and accurate
2. ☐ Want more illustrations such as*
3. ☐ Some are superfluous such as*

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The part number of my instruction manual is:

(This number will be found on the cover or on the title page)

My name is
Company
Address
City State Zip
Date
Phone No. (include area code)

*Whenever possible, give complete model number of equipment, and part number of diagram or part number of instruction section. **This information is important.**

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USER QUESTIONNAIRE

To the User of This Instruction Manual:

Motorola is engaged in a continuous program of improving its instruction literature. We believe that you can aid us in this program, so that we in turn can better help you service our equipment. To foster these aims, would you please answer the following questions:

SCHEMATIC DIAGRAMS AND CABLING DIAGRAMS

1. ☐ Are accurate and easy to follow
2. ☐ Contain minor errors
3. ☐ Contain major errors
4. ☐ Are difficult to follow

If you have checked any box except 1, please tell us what schematic diagrams, or portions thereof, were at fault, or enter other comments.*

TEXT

1. ☐ Easy to follow — helps to service equipment
2. ☐ Would like more information on*
3. ☐ Some instruction sections are too long or superfluous such as*
4. ☐ Other comments*

(continued on reverse side)

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CABLE KITS

parts list

TKN6570A RF Cable Assembly Receiver (W101) PL-5144-O

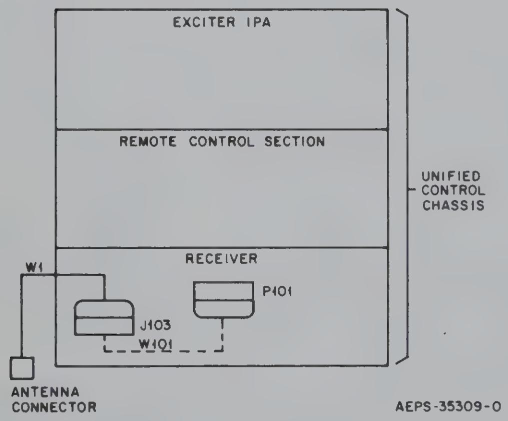
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
J103	9-84968D01	BNC bulkhead type
P101	28-82331G01	single contact
		non-referenced item
	30-83794C01	CABLE, coaxial; 17" lg.

TKN8307A Cable Receiver Link PL-8187-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	29-847854	LUG, tongue: 4 used
	42-10217A02	STRAP, tie

TKN8269A Cable, RF Receiver PL-8188-O

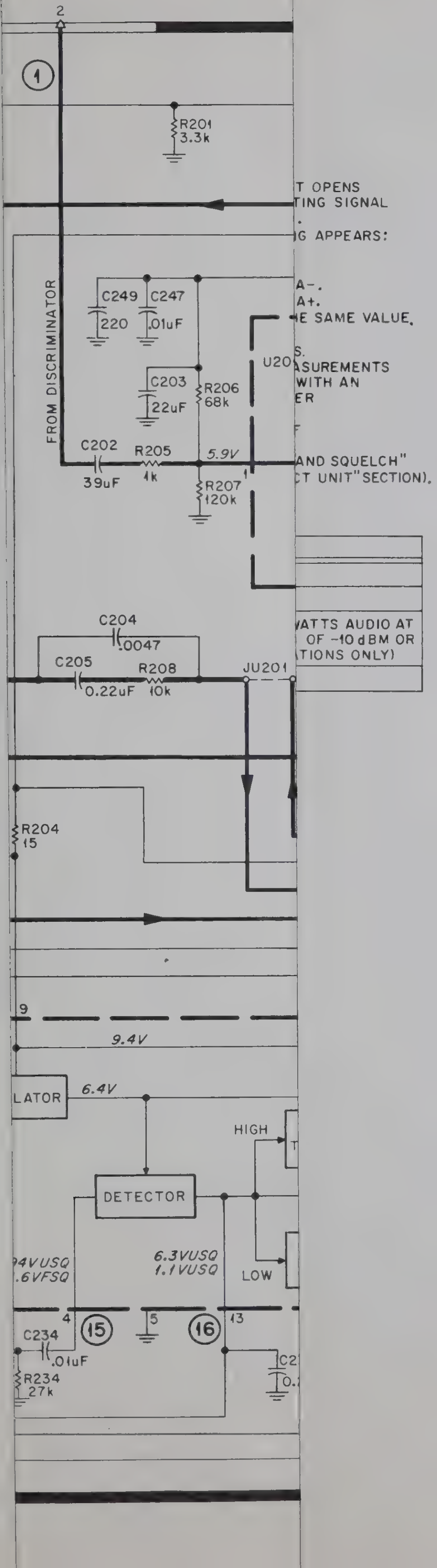
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector:
P103	9-82442E01	female; single contact
		cable:
W1	1-80792B99	ASSEMBLY, rf receiver cable; includes:
	3-134212	SCREW, tapping: 4-40 × 5/16"; 4 used
	7-82674L01	BRACKET, relay mounting
	15-483599	HOOD, receptacle
	30-84173E01	CABLE, coaxial shielded: 8" used; reference P103
	3-134212	SCREW, tapping: 4-40 × 5/16"; 2 used


EXCITER IPA
REMOTE CONTROL SECTION
UNIFIED CONTROL CHASSIS
RECEIVER
W1
P101
J103
W101
ANTENNA CONNECTOR

AEPS-35309-O

RECEIVER FLAT AUDIO BOARD

MODEL TRN5363A


2
1
R201 3.3k
T OPENS
TING SIGNAL
G APPEARS:
FROM DISCRIMINATOR
C249 220
C247 .01uF
A-.
A+.
E SAME VALUE.
U20
S.
ASUREMENTS
WITH AN
ER
F
C203 22uF
R206 68k
C202 39uF
R205 1k
5.9V
R207 120k
AND SQUELCH"
CT UNIT" SECTION).
C204 .0047
C205 0.22uF
R208 10k
JU201
WATTS AUDIO AT
OF -10 dBM OR
TIONS ONLY)
R204 15
9
9.4V
LATOR
6.4V
HIGH
DETECTOR
LOW
94VUSQ
.6VFSQ
6.3VUSQ
1.1VUSQ
4
15
5
16
13
C234 .01uF
R234 27k
C2
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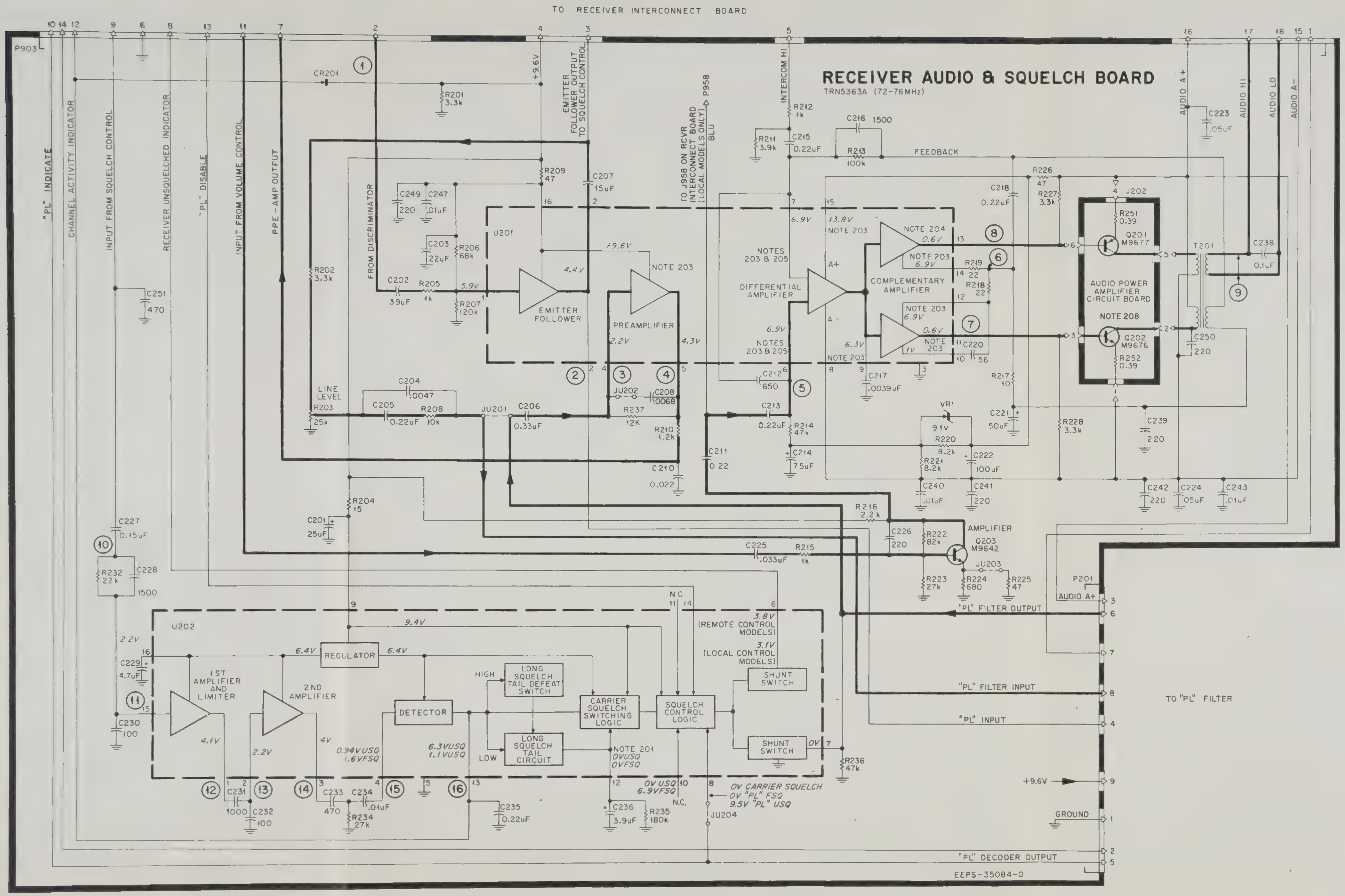
RECEIVER FLAT AUDIO BOARD

RECEIVER FLAT AUDIO BOARD

MODEL TRN5363A


TO RECEIVER INTERCONNECT BOARD
P903
RECEIVER AUDIO & SQUELCH BOARD
TRN5363A (72-76MHz)
"PL" INDICATE
CHANNEL ACTIVITY INDICATOR
INPUT FROM SQUELCH CONTROL
RECEIVER UNSQUELCHED INDICATOR
"PL" DISABLE
INPUT FROM VOLUME CONTROL
PPE-AMP OUTPUT
FROM DISCRIMINATOR
EMITTER FOLLOWER OUTPUT TO SQUELCH CONTROL
TO J958 ON RCVR. INTERCONNECT BOARD (LOCAL MODELS ONLY) P958 BLU
INTERCOM HI
AUDIO A+
AUDIO HI
AUDIO LO
AUDIO A-
U201
EMITTER FOLLOWER
PREAMPLIFIER
DIFFERENTIAL AMPLIFIER
COMPLEMENTARY AMPLIFIER
FEEDBACK
AUDIO POWER AMPLIFIER CIRCUIT BOARD
NOTE 208
J202
Q201 M9677
Q202 M9676
T201
LINE LEVEL
AMPLIFIER
Q203 M9642
U202
1ST AMPLIFIER AND LIMITER
2ND AMPLIFIER
REGULATOR
DETECTOR
LONG SQUELCH TAIL DEFEAT SWITCH
LONG SQUELCH TAIL CIRCUIT
CARRIER SQUELCH SWITCHING LOGIC
SQUELCH CONTROL LOGIC
SHUNT SWITCH
3.8V (REMOTE CONTROL MODELS)
3.1V (LOCAL CONTROL MODELS)
NOTE 201 0VUSQ 0VFSQ
0V CARRIER SQUELCH 0V "PL" FSQ 9.5V "PL" USQ
P201
"PL" FILTER OUTPUT
"PL" FILTER INPUT
"PL" INPUT
"PL" DECODER OUTPUT
TO "PL" FILTER
+9.6V
GROUND
EEPS-35084-0

NOTES

201. +5.6 VOLTS WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH (I.E., APPROXIMATELY 6 dB QUIETING SIGNAL WITH SQUELCH CONTROL AT THRESHOLD).
202. WHERE MORE THAN ONE VOLTAGE READING APPEARS:
     USQ = RECEIVER UNSQUELCHED
     FSQ = RECEIVER FULLY SQUELCHED
203. VOLTAGE MEASURED WITH RESPECT TO A-.
204. VOLTAGE MEASURED WITH RESPECT TO A+.
205. VOLTAGES AT U201-6 AND -7 MUST BE THE SAME VALUE.
206. UNLESS OTHERWISE STATED:
     CAPACITOR VALUES ARE IN PICOFARADS
207 UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES ± 10% MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND
208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD
209 JUMPER JU204 MUST BE REMOVED FOR "AND SQUELCH" OPERATION. (SEE "RECEIVER INTERCONNECT UNIT" SECTION). SEE JUMPER TABLE FOR JUMPER USE.

JUMPER TABLE

JUMPER	USE
JU201	IN
JU202	OUT
JU203	CONNECTED TO PROVIDE 10 WATTS AUDIO AT SPEAKER WITH LINE LEVELS OF -10 dBM OR LESS (REMOTE CONTROL STATIONS ONLY)
JU204	CUT FOR "AND SQUELCH"

REFER
SYM

PART

TLN472

C951
C952,

CR95
954, 9

J904

J953

JU951
JU972

L951

P954,
955-3,
955-5,
956-2,
957-1,
957-3

R951

NOTE

R
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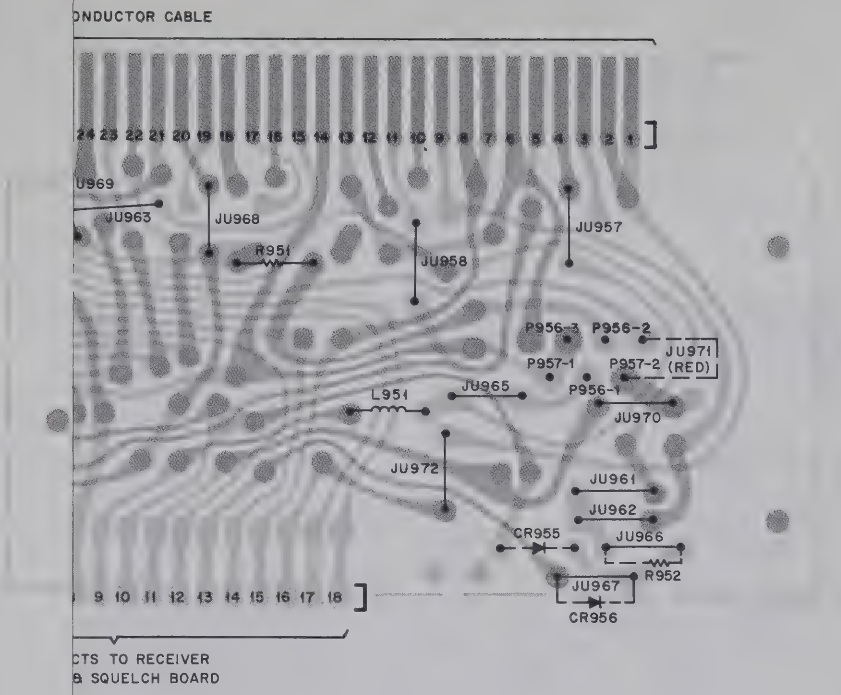
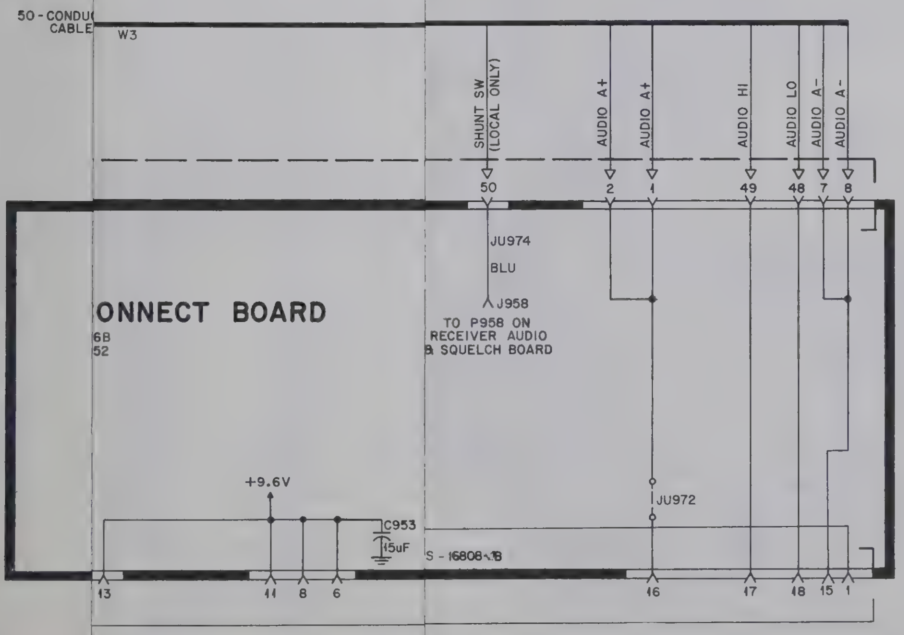

NDUCTOR CABLE
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
U969
JU963
JU968
R951
JU958
JU957
P956-3
P956-2
JU971 (RED)
P957-1
P957-2
P956-1
L951
JU965
JU970
JU972
JU961
JU962
CR955
JU966
R952
JU967
CR956
9 10 11 12 13 14 15 16 17 18
CTS TO RECEIVER
& SQUELCH BOARD


50-CONDU
CABLE
W3
SHUNT SW (LOCAL ONLY)
AUDIO A+
AUDIO A+
AUDIO HI
AUDIO LO
AUDIO A-
AUDIO A-
50
2
1
49
48
7
8
JU974
BLU
J958
TO P958 ON RECEIVER AUDIO & SQUELCH BOARD
ONNECT BOARD
6B
52
+9.6V
C953
15uF
S-16808-B
JU972
13
11
8
6
16
17
18
15
1

NOTES:

951. R960 VOLUME AND R961 SQUELCH CONTROLS ARE NOT USED IN LOCAL CONTROL STATIONS. THESE FUNCTIONS ARE PROVIDED ON THE LOCAL CONTROL PANEL.

952. JUMPER CONNECTIONS ARE AS LISTED ON RECEIVER INTERCONNECT BOARD JUMPER TABLE.

953. JU951 IS CONNECTED IN SINGLE FREQUENCY RECEIVERS ONLY. RECEIVER CHANNEL ELEMENT IS ALWAYS ACTIVATED.

954. CR955, CR956, & R952 ARE USED AND JUMPERS JU966 AND JU967 ARE OMITTED FOR "AND SQUELCH" OPERATION (JU204 ON AUDIO & SQUELCH BOARD MUST ALSO BE CUT) AND ARE NOT PART OF THE RECEIVER INTERCONNECT BOARD.

955. CR957 REMOVED FOR REPEAT OR DUPLEX OPERATION.

956. UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN PICOFARADS.

TLN4726B Receiver Interconnect Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-16959-D
6/20/80-PHI

PARTS LIST

TLN4726B Receiver Interconnect Board PL-3239-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
[illegible]	21-82428B59	.01 uF +80-20%: 200 V
[illegible]	23-84762H09	.15 uF ±20%: 20 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
[illegible]	[illegible]	silicon
		CONNECTOR, receptacle:
[illegible]		consists of: 9-83011H01 TERMINAL, contact; female; 11 required (mounts on edge of circuit bd.) (for reference only; consists of "fingers" of plated circuit used as "plug contacts" for connecting circuit board with a mating receptacle)
		JUMPER:
[illegible]		(for reference only)
[illegible]	[illegible]	[illegible]
[illegible]	39-10184A30	[illegible]
		RESISTOR, fixed:
[illegible]	[illegible]	3.3k ±10%; 1/4 W

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

TLN5060A Optional "And Squelch" Parts PL-2573-A

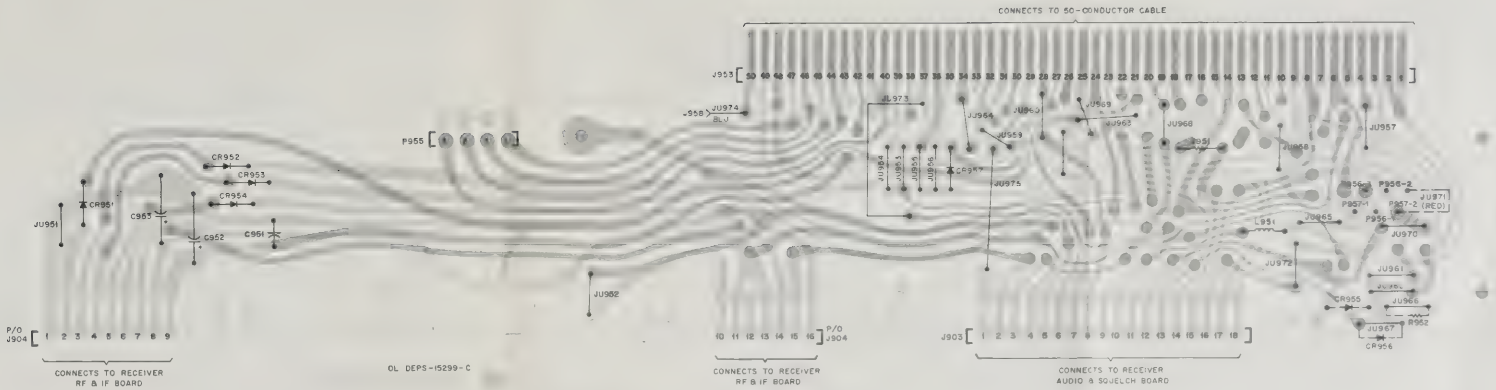
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
[illegible]	48-82392B03	silicon
[illegible]	48-82392B03	silicon
		RESISTOR, fixed:
R952	[illegible]	10k ±10%; 1/4 W

TLN5184A "Extender" On-Off Switch Kit PL-5081-O

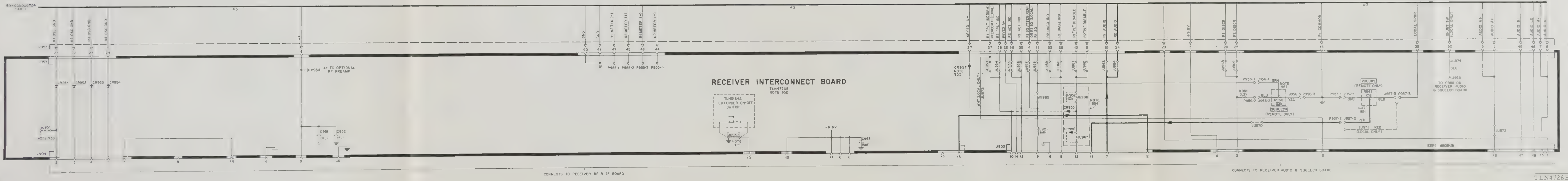
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
[illegible]	40-82085J03	SWITCH, toggle: spdt
NON-REFERENCED ITEMS		
	4-1725	WASHER, flat: .266 x .562 x .040; 2 used
	54-84861G01	LABEL: Extender On-Off

TLN4727A Receiver Chassis & Hardware Kit
(132-174 MHz only)
TLN4755A Receiver Chassis & Hardware Kit
(25-50 MHz & 72-76 MHz only) PL-1750-D

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		RESISTOR, variable:
R960, 961	18-82515B50	25k; includes mtg. hardware
	1-80709B39	SHIELD, receiver (TLN4727A only)
	1-80707B15	SHIELD, receiver (TLN4755A only)
	1-80727B83	CHASSIS ASSEMBLY receiver (TLN4727A only)
	1-80728B56	CHASSIS ASSEMBLY receiver (TLN4755A only)
	1-80728B57	SHIELD, audio & squelch
	26-84434D01	HEATSINK
	36-82620H02	KNOB, control: 2 req'd. (VOLUME & SQUELCH)
	41-841889G01	SPRING, retaining
	55-84300B01	HANDLE: 3 req'd.
	2-7005	NUT, hex: 6-32 x 1/4" x 3/32": 3 req'd.
	3-134168	SCREW, tapping: 4-40 x 1/4"; w/Internal Lockwasher;6 req'd.
	3-134169	SCREW, tapping: 4-40 x 1/4"; w/External Lockwasher; 1 req'd.
	3-135337	SCREW, machine: 6-32 x 9/16"; "Phillips" flat head; 3 req'd.
	3-135715	SCREW, tapping: 6-32 x 11/16"; w/External Lockwasher; 3 req'd. (TLN4727A only)
	4-7666	LOCKWASHER: No. 6 split; 3 req'd.
	4-84516B01	WASHER, screw retainer: 3 req'd. (TLN4727A only)
	11-490487	GREASE, silicon


CONNECTS TO 50-CONDUCTOR CABLE
J953
P955
P/O J904
CONNECTS TO RECEIVER RF & IF BOARD
OL DEPS-15299-C
P/O J904
CONNECTS TO RECEIVER RF & IF BOARD
J903
CONNECTS TO RECEIVER AUDIO & SQUELCH BOARD
JU951
CR951
C951
C952
CR952
CR953
CR954
JU962
JU974
JU975
JU957

SHOWN FROM COMPONENT SIDE


50-CONDUCTOR CABLE
P951
J952
RECEIVER INTERCONNECT BOARD
TLN4726 NOTE 952
TLN5184A EXTENDER ON-OFF SWITCH
+9.6V
VOLUME (REMOTE ONLY)
SQUELCH (REMOTE ONLY)
TO P958 ON RECEIVER AUDIO & SQUELCH BOARD
A+ TO OPTIONAL RF PREAMP
J903
J904
CONNECTS TO RECEIVER RF & IF BOARD
CONNECTS TO RECEIVER AUDIO & SQUELCH BOARD

NOTES:

951. R960 VOLUME AND R961 SQUELCH CONTROLS ARE NOT USED IN LOCAL CONTROL STATIONS THESE FUNCTIONS ARE PROVIDED ON THE LOCAL CONTROL PANEL

952. JUMPER CONNECTIONS ARE AS LISTED ON RECEIVER INTERCONNECT BOARD JUMPER TABLE

953. JU951 IS CONNECTED IN SINGLE FREQUENCY RECEIVERS ONLY RECEIVER CHANNEL ELEMENT IS ALWAYS ACTIVATED

954. CR955, CR956, & R952 ARE USED AND JUMPERS JU966 AND JU967 ARE OMITTED FOR "AND SQUELCH" OPERATION (JU204 ON AUDIO & SQUELCH BOARD MUST ALSO BE CUT) AND ARE NOT PART OF THE RECEIVER INTERCONNECT BOARD

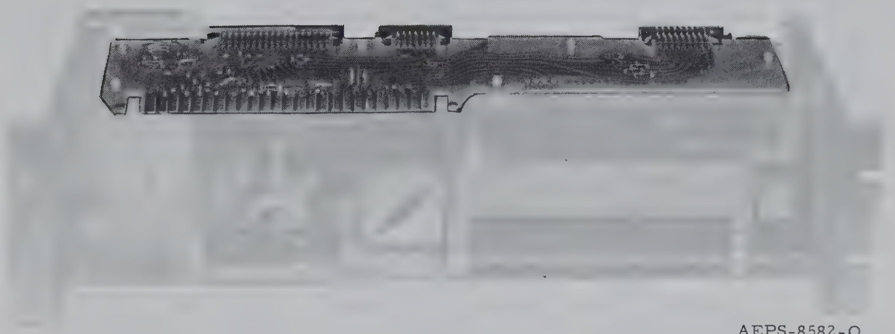
955. CR957 REMOVED FOR REPEAT OR DUPLEX OPERATION

956. UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN PICOFARADS

TLN4726B Receiver Interconnect Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-16959- D
6/20/80-PHI

RECEIVER INTERCONNECT BOARD

MODEL TLN4726B



AEPS-8582-O

1. DESCRIPTION

The receiver interconnect board connects the receiver rf and i-f board and the receiver audio and squelch board to the station 50-conductor intercable.

A number of jumpers are provided to allow use of the board in single and two-receiver stations, and local and remote control stations. Jumper connections for these modes of operations are shown in Table 1.

2. "AND SQUELCH" OPERATION

An optional mode of receiver operation known known as "AND SQUELCH" can be added when desirable. This feature provides "variable PL sensitivity" (tone-coded squelch plus adjustable noise-activated [carrier] squelch).

In this mode, the receiver audio channel is activated when a PL tone is received and the carrier squelch threshold level is exceeded. Since the carrier (noise-activated) squelch circuit sensitivity is adjustable, and since it is one of the controlling factors in the squelching of receiver audio, the operation can be aptly described as "variable PL sensitivity". Thus "AND SQUELCH" denotes both tone-coded squelch and carrier squelch operating simultaneously.

Conversion of the receiver to the "AND SQUELCH" mode of operation requires the addition of certain components to the RECEIVER INTERCONNECT UNIT, and the omission of certain jumpers in both the RECEIVER INTERCONNECT UNIT and the AUDIO & SQUELCH BOARD.

The parts required to convert the receiver to "AND SQUELCH" operation are listed on the back of the schematic diagram.

Refer to the AUDIO & SQUELCH section of this manual for further details relating to "AND SQUELCH" operation.

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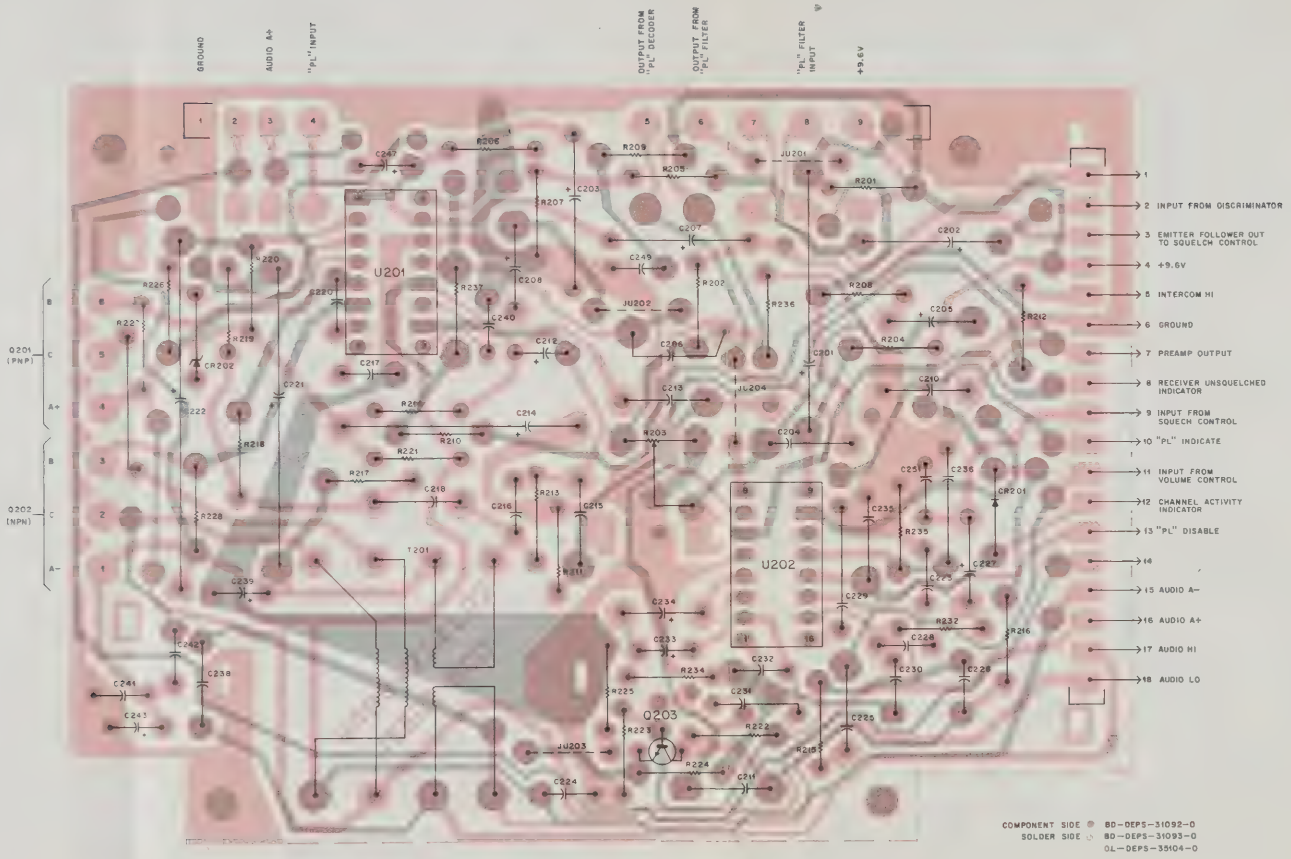
RECEIVER FLAT AUDIO BOARD

MODEL TRN5363A

FUNCTION

TRN5363A Receiver Flat Audio Board contains the receiver audio and squelch circuits. The audio circuits do not de-emphasize the audio signals.


GROUND
AUDIO A+
"PL" INPUT
OUTPUT FROM "PL" DECODER
OUTPUT FROM "PL" FILTER
"PL" FILTER INPUT
+9.6V
1 2 3 4 5 6 7 8 9
1
2 INPUT FROM DISCRIMINATOR
3 EMITTER FOLLOWER OUT TO SQUELCH CONTROL
4 +9.6V
5 INTERCOM HI
6 GROUND
7 PREAMP OUTPUT
8 RECEIVER UNSQUELCHED INDICATOR
9 INPUT FROM SQUECH CONTROL
10 "PL" INDICATE
11 INPUT FROM VOLUME CONTROL
12 CHANNEL ACTIVITY INDICATOR
13 "PL" DISABLE
14
15 AUDIO A−
16 AUDIO A+
17 AUDIO HI
18 AUDIO LO
Q201 (PNP)
Q202 (NPN)
B
C
A+
B
C
A−
U201
U202
Q203
T201
CR201
CR202
JU201
JU202
JU203
JU204
COMPONENT SIDE ● BD-DEPS-31092-O
SOLDER SIDE ○ BD-DEPS-31093-O
OL-DEPS-35104-O

SHOWN FROM SOLDER SIDE

parts list

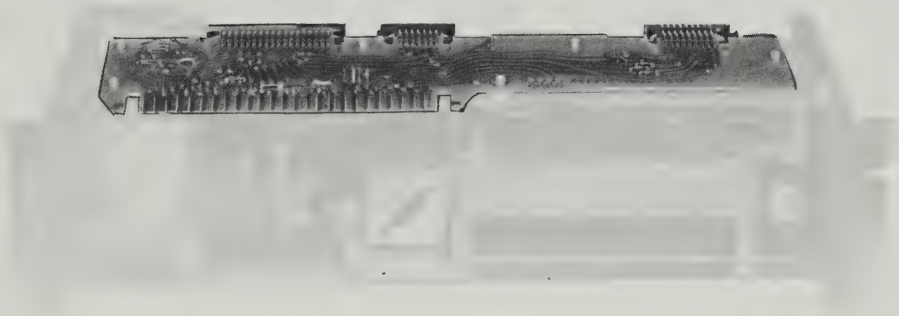
TRN5363A Receiver Flat Audio Board PL-8136-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%; 100 V: unless otherwise stated
C201	23-83210A01	25 + 150-10%; 25 V
C202	23-82783B36	39; 10 V
C203	23-84762H10	22 ± 20%; 15 V
C204	8-83813H12	.0047
C205	8-83813H11	0.22; 75 V
C206	8-83813H29	0.33; 50 V
C207	23-82783B24	15; 25 V
C208	8-83813H01	.0068
C209		NOT USED
C210	8-83813H16	.022 ± 5%; 50 V
C211	8-83813H11	0.22; 75 V
C212	21-848236	650 pF ± 5%; 500 V
C213	8-83813H11	0.22; 75 V
C214	23-84081B03	75 + 150-10%; 15 V
C215	8-83813H11	0.22; 75 V
C216	21-82187B11	1500 pF
C217	21-82187B43	.0039; 200 V
C218	8-83813H11	0.22; 75 V
C219		NOT USED
C220	21-83406D46	56 pF ± 5%; 500 V; N150
C221	23-84081B01	50 + 100-10% 25 V
C222	23-83210A08	100 + 150-10%, 25 V
C223, 224	21-82372C04	.05 + 80-20%; 25 V
C225	8-82905G16	.033
C226	21-859942	220 pF ± 5%; 500 V
C227	8-83813H07	0.15; 75 V
C228	21-84426B63	1500 pF ± 5%
C229	23-84762H07	4.7 ± 20%; 10 V
C230	21-84426B06	100 pF ± 5%; 500 V
C231	21-84493B05	1000 pF; 200 V; N2200
C232	21-82133G03	100 pF ± 5%; 500 V; N750
C233	21-84426B11	470 pF ± 5%; 500 V
C234	8-83813H31	.01; 100 V
C235	8-83813H11	0.22; 75 V
C236	23-84762H08	3.9 ± 20%; 15 V
C237		NOT USED
C238	21-82372C01	0.1 + 80-20%, 25 V
C239	21-83596E10	220 pF ± 20%, 500 V
C240	21-832501	.01 + 60-40%; 250 V
C241, 242	21-83596E10	220 pF ± 20%; 500 V
C243	21-832501	.01 + 60-40%; 250 V
C244	21-82133G03	100 pF ± 5%; 500 V
C245, 246		NOT USED
C247, 248	21-832501	.01 + 60-40%; 250 V
C249, 250	21-83596E10	220 pF ± 20%, 500 V
C251	21-84426B11	470 pF ± 5%; 500 V
		diode: (see note)
CR201	48-83654H01	silicon
		connector, plug:
P201		consists of contact pins mounted on circuit board
		transistor: (see note)
Q203	48-869642	NPN; type M9642
		resistor, fixed: ± 5%; 1/4 W: unless otherwise stated
R201, 202	6-11009C61	3.3k
R203	18-83083G24	variable: 25k ± 30%
R204	6-11009C05	15
R205	6-11009C47	1k
R206	6-11009C93	68k
R207	6-11009C99	120k
R208	6-11009C73	10k
R209	6-11009C17	47
R210	6-11009C51	1.2k
R211	6-11009C63	3.9k
R212	6-11009C49	1k
R213	6-11009C97	100k
R214	6-11009C89	47k
R215	6-11009C49	1k
R216	6-11009C57	2.2k
R217	6-11009C01	10
R218, 219	6-11009C09	22
R220, 221	6-11009C71	8.2k
R222	6-11009C95	82k
R223	6-11009C83	27k
R224	6-11009C45	680
R225, 226	6-11009C17	47
R227, 228	6-11009C61	3.3k
R229 thru 231		NOT USED
R232	6-11009C81	22k
R233		NOT USED
R234	6-11009C83	27k
R235	6-11009D04	180k ± 10%
R236	6-11009C89	47k
R237	6-11009C75	12k
		transformer, af:
T201	25-84083B02	pri: split winding; total res 0.5 ohms max sec res 0.8 ohms max feedback. res 2 ohms max
		integrated circuit: (see note)
U201	51-82848M70	type M4870
U202	51-84561L79	type M6179
		diode: (see note)
VR1	48-82256C38	Zener, 9 1 V, 400 mW
		non-referenced items
	42-84284B01	RETAINER: 4 req'd.
	3-138162	SCREW, tapping: Phillips rd. hd., 4-40 × 3/8''; 4 req'd. (used for mounting retainers)
	55-84300B01	HANDLE (long)
	55-84300B02	HANDLE (short)
	29-84028H01	TERMINAL, contact: 18 req'd. (long)
	29-84028H02	TERMINAL, contact, 24 req'd. (short)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers

RECEIVER INTERCONNECT BOARD

MODEL TLN4726B



AEPS-8582-O

1. DESCRIPTION

The receiver interconnect board connects the receiver rf and i-f board and the receiver audio and squelch board to the station 50-conductor intercable.

A number of jumpers are provided to allow use of the board in single and two-receiver stations, and local and remote control stations. Jumper connections for these modes of operations are shown in Table 1.

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The parts required to convert the receiver to "AND SQUELCH" operation are listed on the back of the schematic diagram.

Refer to the AUDIO & SQUELCH section of this manual for further details relating to "AND SQUELCH" operation.

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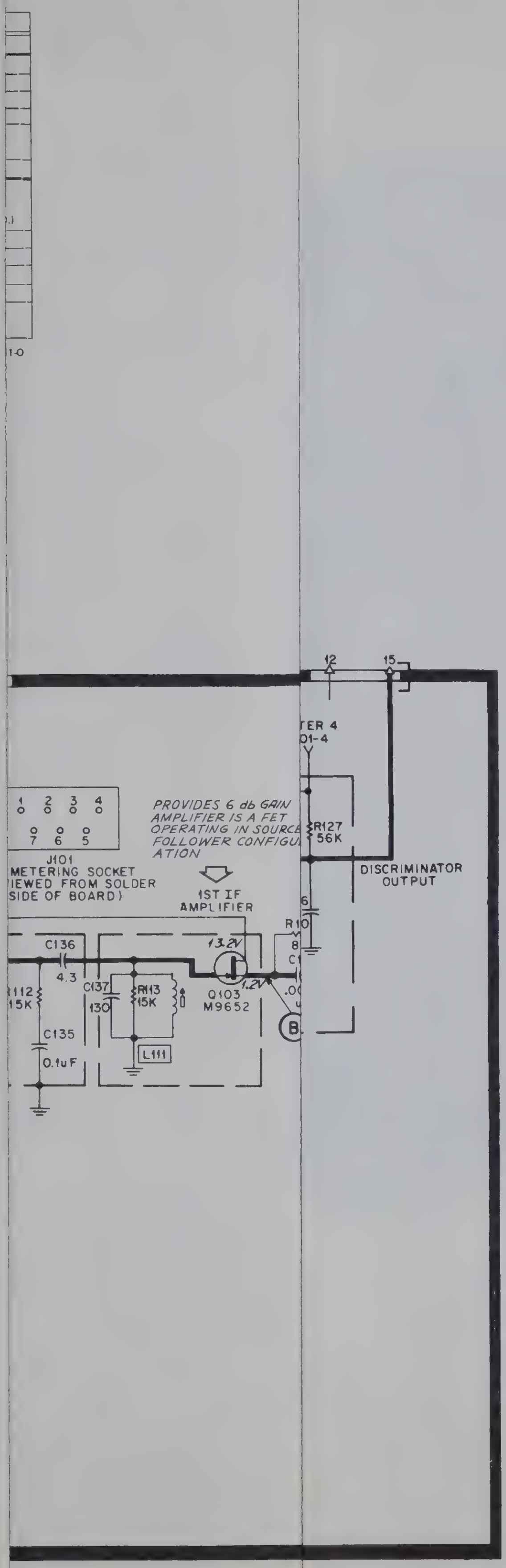
TABLE 1.
JUMPER TABLE

	SINGLE-RECEIVER STATION		TWO-RECEIVER STATION			
			RECEIVER #1		RECEIVER #2	
JUMPER JU	REMOTE CONTROL	LOCAL CONTROL	REMOTE CONTROL	LOCAL CONTROL	REMOTE CONTROL	LOCAL CONTROL
951	NOTE 953					
952	IN	IN	IN	IN	IN	IN
953	IN	OUT	IN	OUT	OUT	OUT
954	IN	IN	OUT	IN	IN	OUT
955	IN	IN	OUT	OUT	IN	IN
956	IN	IN	IN	IN	OUT	OUT
957	*IN	OUT	*IN	OUT	OUT	IN
958	*IN	IN	*IN	IN	OUT	OUT
959	IN	OUT	OUT	OUT	IN	IN
960	IN	IN	IN	IN	OUT	OUT
961	IN	IN	IN	IN	IN	IN
962	IN	IN	IN	IN	IN	IN
963	IN	IN	IN	IN	OUT	OUT
964	IN	OUT	OUT	OUT	IN	IN
965	IN	IN	IN	IN	IN	IN
966	IN	IN	IN	IN	IN	IN
967	IN	IN	IN	IN	IN	IN
968	IN	IN	IN	IN	OUT	OUT
969	OUT	IN	OUT	OUT	OUT	IN
970	IN	IN	IN	IN	IN	OUT
971	OUT	IN	OUT	IN	OUT	IN
972	IN	IN	IN	IN	OUT	OUT
973	OUT	IN	OUT	IN	OUT	OUT
974	OUT	IN	OUT	IN	OUT	IN

* = OUT FOR REPEATER STATIONS



).)
1-0
12
15
TER 4
01-4
R127
56K
DISCRIMINATOR OUTPUT
1 2 3 4
7 6 5
J101
METERING SOCKET
IEWED FROM SOLDER
SIDE OF BOARD)
PROVIDES 6 db GAIN AMPLIFIER IS A FET OPERATING IN SOURCE FOLLOWER CONFIGU ATION
1ST IF AMPLIFIER
C136
4.3
13.2V
1.2V
R10
8
C
.00
4
R112
15K
C137
130
R113
15K
Q103
M9652
C135
0.1uF
L111
B
6

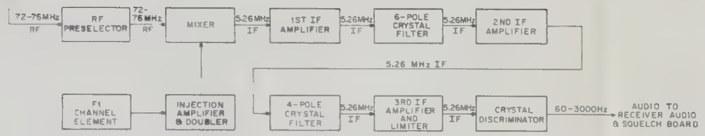
MID BAND RECEIVER RF & I-F BOARD

PARTS LISTS SHOWN ON
BACK OF THIS DIAGRAM
Receiver RF & I-F Schematic and Block Diagrams
Motorola No. ***PEPS-17908-C***
10/8/82- PH1

TABLE 1.
JUMPER TABLE

JUMPER JU	SINGLE-RECEIVER STATION		TWO-RECEIVER STATION			
			RECEIVER #1		RECEIVER #2	
	REMOTE CONTROL	LOCAL CONTROL	REMOTE CONTROL	LOCAL CONTROL	REMOTE CONTROL	LOCAL CONTROL
951	NOTE 953					
952	IN	IN	IN	IN	IN	IN
953	IN	OUT	IN	OUT	OUT	OUT
954	IN	IN	OUT	IN	IN	OUT
955	IN	IN	OUT	OUT	IN	IN
956	IN	IN	IN	IN	OUT	OUT
957	*IN	OUT	*IN	OUT	OUT	IN
958	*IN	IN	*IN	IN	OUT	OUT
959	IN	OUT	OUT	OUT	IN	IN
960	IN	IN	IN	IN	OUT	OUT
961	IN	IN	IN	IN	IN	IN
962	IN	IN	IN	IN	IN	IN
963	IN	IN	IN	IN	OUT	OUT
964	IN	OUT	OUT	OUT	IN	IN
965	IN	IN	IN	IN	IN	IN
966	IN	IN	IN	IN	IN	IN
967	IN	IN	IN	IN	IN	IN
968	IN	IN	IN	IN	OUT	OUT
969	OUT	IN	OUT	OUT	OUT	IN
970	IN	IN	IN	IN	IN	OUT
971	OUT	IN	OUT	IN	OUT	IN
972	IN	IN	IN	IN	OUT	OUT
973	OUT	IN	OUT	IN	OUT	OUT
974	OUT	IN	OUT	IN	OUT	IN

* = OUT FOR REPEATER STATIONS


72-76MHz
RF
RF PRESELECTOR
72-76MHz
RF
MIXER
5.26MHz
IF
1ST IF AMPLIFIER
5.26MHz
IF
6-POLE CRYSTAL FILTER
5.26MHz
IF
2ND IF AMPLIFIER
5.26 MHz IF
F1 CHANNEL ELEMENT
INJECTION AMPLIFIER & DOUBLER
4-POLE CRYSTAL FILTER
5.26MHz
IF
3RD IF AMPLIFIER AND LIMITER
5.26MHz
IF
CRYSTAL DISCRIMINATOR
60-3000Hz
AUDIO TO RECEIVER AUDIO & SQUELCH BOARD

69C81018E34-A

DC VOLTAGE TABLE FOR IC'S

PIN	VOLTAGE
IC101	
1	3.0V (SLIGHTLY HIGHER THAN PINS 8 AND 9)
5	9.5V (VARIES WITH 9.6V LINE)
6	7.2V
7	6.4V
8 9	2.9V (PINS 8 AND 9 MUST BE EQUAL)
IC102	
1 3	3.0V (PINS 1 AND 3 MUST BE EQUAL AND SLIGHLY HIGHER THAN PINS 8 AND 9 PIN 1 MUST BE BY PASSED TO GND WITH .01 uF CAP WHEN MEASURED I
4	6.3V (3.0V LOWER THAN PIN 5)
5	9.3V (VARIES WITH 9.6V LINE)
6	7.2V
7	6.4V
8 9	2.9V (PINS 8 AND 9 MUST BE EQUAL)

EPS 10051-O

RF VOLTAGE TABLE

SET RF INPUT AT ANT TO OBTAIN (NOTE 103)	AT TEST POINT	RF INPUT SHOULD BE (MAY VARY APPROX 2 TO 1)	
0.5V	Ⓐ	8.0 mV	SIG GEN SET TO RECEIVER CHAN FREQ
100 mV	Ⓑ	6.0 mV	
	Ⓒ	5.0 mV	
	Ⓓ	10.0 uV	
	Ⓔ	20.0 uV	

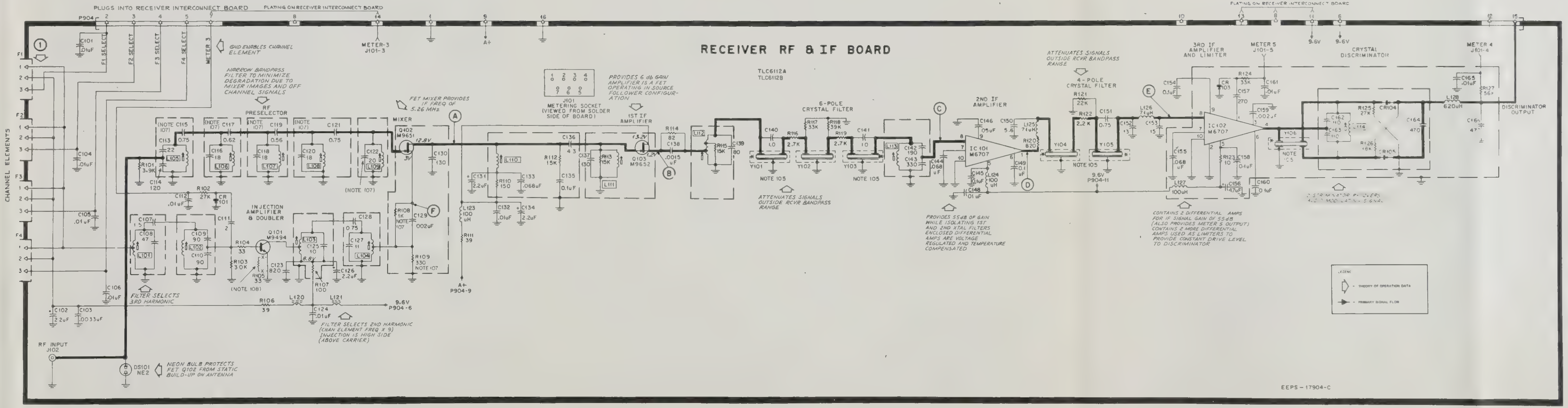
TEST POINT	RANGE	RF VOLTAGE (NOTE 103)
Ⓕ	72 76 MHZ	0.9-1.5V

EPS 10052-A

RECEIVER RF & IF BOARD

101 RECEIVER FREQUENCY CALCULATIONS SEE ALIGNMENT PROCEDURE
102 DASHED LINES REPRESENT SHIELDING
103. RF MEASUREMENTS TAKEN WITH MOTOROLA SOLID-STATE DC MULTIMETER WITH PLUG IN RF PROBE
104 UNLESS OTHERWISE STATED DC VOLTAGES GIVEN ARE NOMINAL AND MAY VARY ±25 PER CENT DC VOLTAGES ARE MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND
105 INDEX ASTERISK ON CRYSTAL CAN INDICATES PHYSICAL ORIENTATION
106 VALUES ARE IN PICOFARADS RESISTOR VALUES ARE IN OHMS
107 USED IN MODEL TLC6112B ONLY
108 R105 IS USED IN MODEL TLC6112A ONLY

EPS-10050-A


PLUGS INTO RECEIVER INTERCONNECT BOARD
PLATING ON RECEIVER INTERCONNECT BOARD
P904
F1 SELECT
F2 SELECT
F3 SELECT
F4 SELECT
METER 3
METER-3 J101-3
A+
CHANNEL ELEMENTS
F1
F2
F3
F4
RECEIVER RF & IF BOARD
TLC6112A
TLC6112B
RF PRESELECTOR
MIXER
Q102 M9651
12.8V
INJECTION AMPLIFIER & DOUBLER
Q101 M9494
J101 METERING SOCKET (VIEWED FROM SOLDER SIDE OF BOARD)
1ST IF AMPLIFIER
Q103 M9652
6-POLE CRYSTAL FILTER
2ND IF AMPLIFIER
IC101 M6707
4-POLE CRYSTAL FILTER
3RD IF AMPLIFIER AND LIMITER
IC102 M6707
METER 5 J101-5
CRYSTAL DISCRIMINATOR
METER 4 J101-4
DISCRIMINATOR OUTPUT
9.6V
9.6V P904-11
9.6V P904-6
A+ P904-9
RF INPUT J102
DS101 NE2
NOTE 105
(NOTE 107)
(NOTE 108)
LEGEND
THEORY OF OPERATION DATA
PRIMARY SIGNAL FLOW

GND ENABLES CHANNEL ELEMENT

NARROW BANDPASS FILTER TO MINIMIZE DEGRADATION DUE TO MIXER IMAGES AND OFF CHANNEL SIGNALS

FET MIXER PROVIDES IF FREQ OF 5.26 MHz

PROVIDES 6 db GAIN AMPLIFIER IS A FET OPERATING IN SOURCE FOLLOWER CONFIGURATION

ATTENUATES SIGNALS OUTSIDE RCVR BANDPASS RANGE

PROVIDES 55dB OF GAIN WHILE ISOLATING 1ST AND 2ND XTAL FILTERS ENCLOSED DIFFERENTIAL AMPS ARE VOLTAGE REGULATED AND TEMPERATURE COMPENSATED

ATTENUATES SIGNALS OUTSIDE RCVR BANDPASS RANGE

CONTAINS 2 DIFFERENTIAL AMPS FOR IF SIGNAL GAIN OF 55dB (ALSO PROVIDES METER 5 OUTPUT) CONTAINS 2 MORE DIFFERENTIAL AMPS USED AS LIMITERS TO PROVIDE CONSTANT DRIVE LEVEL TO DISCRIMINATOR

[illegible]

FILTER SELECTS 3RD HARMONIC

FILTER SELECTS 2ND HARMONIC (CHAN ELEMENT FREQ X 9) INJECTION IS HIGH SIDE (ABOVE CARRIER)

NEON BULB PROTECTS FET Q102 FROM STATIC BUILD-UP ON ANTENNA

EEPS-17904-C

PARTS LISTS SHOWN ON
BACK OF THIS DIAGRAM
Receiver RF & I-F Schematic and Block Diagrams
Motorola No. ***PEPS-17908-C***
10. 8. 82- PHI

MID BAND RECEIVER RF & I F BOARD

es PL-936-B

	DESCRIPTION
3	HANDLE
	LOCKSCREW, tapping: No. 4-40 x 5/16" "Phillips" hex head
1	SHIELD
1	SHIELD
1	SHIELD
	GROMMET, "nylon"
2	HANDLE
1	RETAINER, screw (8 req'd)
	LOCKSCREW, tapping: No. 4-40 x 5/16" "Phillips" round head (8 req'd)
1	SHIELD
4	CAN, square (staked)
1	SPRING, retainer
	BRACKET, lamp holder
9	RECEPTACLE, female (22 req'd)
1	TERMINAL, male
1	CAN, square (staked)
	TERMINAL, pin; male
2	CAN, square (staked)
3	CAN, square (staked)
1	CAN, square (staked)
2	CAN, square (staked)
1	INSULATOR, crystal
	WASHER, spacer

IONS 68P81026E36-D

HANGE	POSITION
ROM 51-84267A07	2ND & 2RD
O 51-84561L69	I-F AMPLIFIER

coils have
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led. Note
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accuracy
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probe in-
than 1/10
(signal is

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probe.

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5. Peak
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Repeat.

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Connect a
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e coils to
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, connect
4 reading
n on- fre-
capacitor
L101 OR
TS ARE

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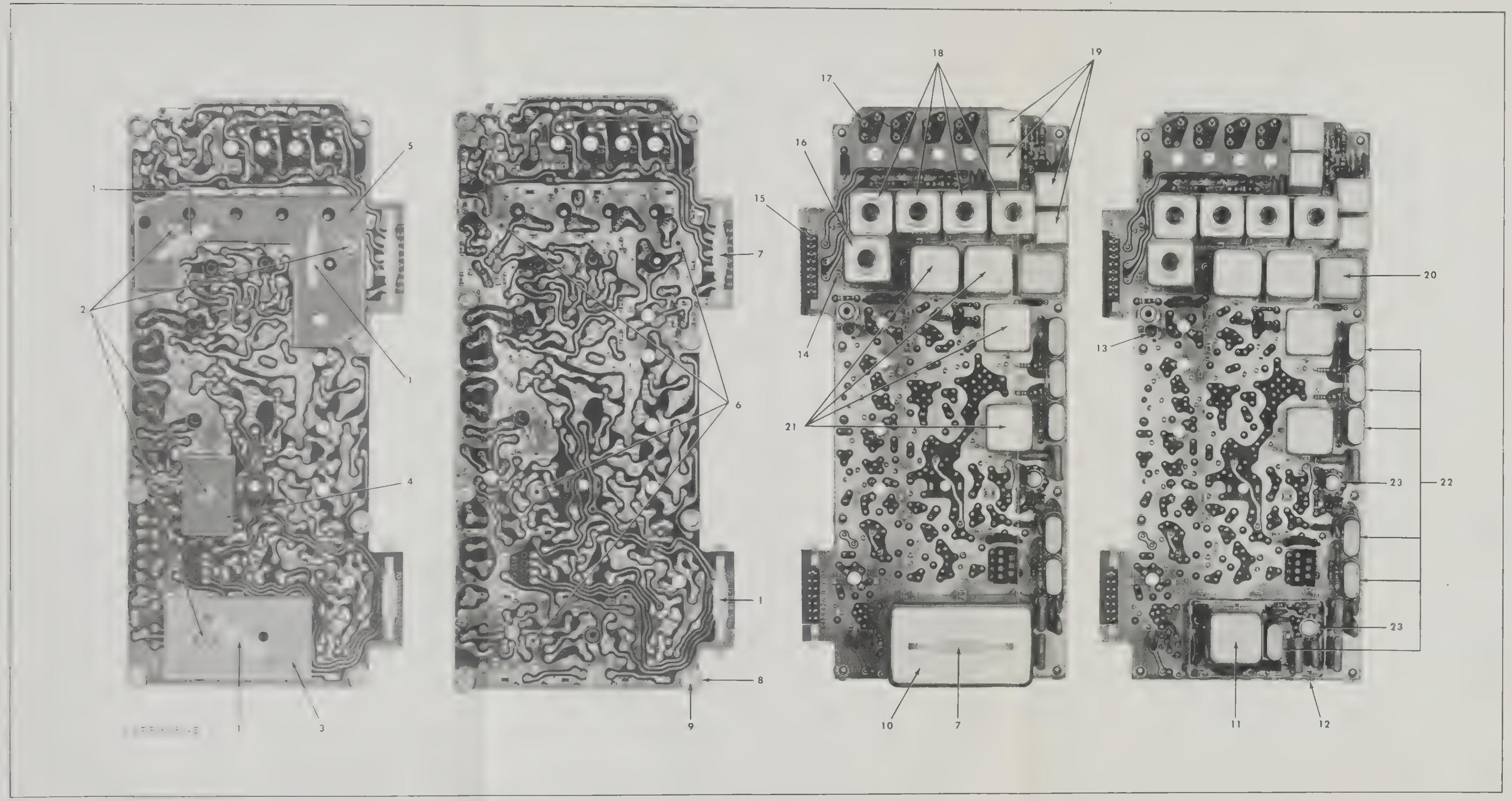


PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TLC6112A & TLC6112B Receiver RF & IF Board (72-76 MHz) PL-2078-D

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: pF: ±5%. 500 V: unless otherwise stated
C101	21D82428B59	.01 uF +80-20%: 200 V
C102	23D84762H04	2.2 uF ±20%: 25 V
C103	21D82428B57	3300 ±10%. 200 V
C104, 105, 106	21D82428B59	.01 uF +80-20%: 200 V
C107	21D82450B13	1.5; coded BRN-GRN-WHT-GOLD
C108	21D83406D44	47: N80
C109, 110	21D84534B02	90
C111	21D82450B18	2: coded RED-BLK-WHT-GOLD
C112	21D82428B59	.01 uF +80-20%: 200 V
C113	21-124554	22: NP0
C114	21-840713	120
C115	21D82450B16	0.62 ±10%: coded BLU-RED-GRAY-SILVER (TLC6112A)
C115	21D82450B48	0.75; coded VIO-GRN-GRY-GOLD (TLC6112B)
C116	21-122235	18; NP0
C117	21D82450B33	0.56; coded GRN-BLU-GRAY-GOLD (TLC6112A)
C117	21D82450B46	0.62; coded BLU-RED-GRY-GOLD (TLC6112B)
C118	21-122235	18; NP0
C119	21D82450B29	0.51; coded GRN-BLU-GRAY-GOLD (TLC6112A)
C119	21D82450B29	0.56; coded GRN-BLU-GRY-GOLD (TLC6112B)
C120	21-122235	18; NP0
C121	21D82450B33	0.56; coded GRN-BLU-GRAY-GOLD (TLC6112A)
C121	21D82450B48	0.75; coded VIO-GRN-GRY-GOLD (TLC6112B)
C122	21-82133G01	10; NP0 (TLC6112A)
C122	21-82610C22	20; NP0 (TLC6112B)
C123	21D82187B17	820 ±10%
C124	21D82428B59	.01 uF +80-20%; 200 V
C125	21-82133G01	10: NP0
C126	23D84762H04	2.2 uF ±20%: 25 V
C127	21-851845	11: NP0
C128	21D82450B48	0.75: coded VIO-GRN-GRAY-GOLD
C129	21-82428B28	.002 uF ±10%: 100 V
C130	21D84426B18	130
C131	23D84762H04	2.2 uF ±20%: 25 V
C132	21D82428B59	.01 uF +80-20%: 200 V
C133	8D82905G04	.068 uF ±10%; 50 V
C134	23D84762H04	2.2 uF ±20%; 25 V
C135	21D82428B59	.01 uF +80-20%: 200 V
C136	21D82450B10	4.3: coded YEL-ORG-WHT-GOLD
C137	21D84426B18	130
C138	21D82187B31	1500 ±10%: 100 V
C139	21D84426B21	80
C140, 141	21D82450B47	1.0: coded BRN-BLK-WHT-GOLD
C142	21D84426B62	190
C143	21D84534B07	330
C144	8D82905G04	.068 uF ±10%; 50 V
C145	21D82428B59	.01 uF +80-20%: 200 V
C146	21C82372C04	.05 uF +80-20%: 25 V
C148	21-82428B59	.01 uF +80-20%: 200 V
C149	8D83813H06	0.1 uF ±10%: 100 V
C150	21D82133G32	5.6 ±0.5 pF: NP0
C151	21D82450B48	0.75: coded VIO-GRN-GRAY-GOLD
C152	21D83406D57	13: NP0
C153	21D82133G19	15: NP0
C154	8D83813H06	0.1 uF ±10%; 100 V
C155	8D82905G04	.068 uF ±10%: 500 V
C156	23D83214C15	4.7 uF ±20%: 25 V
C157	21D82187B38	270 ±10%
C158	8D83813H06	0.1 uF ±10%: 100 V
C159	21D82187B27	2000 ±10%: 100 V
C160	8-83813H06	0.1 uF ±10%: 100 V
C161	21D82428B59	.01 uF +80-20%: 200 V
C162	21D82610C69	110: 200 V: N150
C163	21D84426B59	110
C164	21D82187B39	470 ±10%
C165	21D82428B59	.01 uF +80-20%: 200 V
C166	21D82187B39	470 ±10%
		SEMICONDUCTOR DEVICE, diode:
CR101	48D82139G01	germanium
CR103	48D82139G01	germanium
CR104	48D84616A01	silicon; hot-carrier
CR105	48D84616A01	silicon; hot-carrier
		LAMP, glow:
DS101	65B82267D02	neon: type NE-2
		INTEGRATED CIRCUIT:
IC101	51-84561L69	type M6707
IC102	51-84561L69	type M6707
		CONNECTOR, receptacle:
J101	9C84207B01	female: 7-contact
J102	9C84231B02	female: coaxial; miniature type
		COIL, RF:
L101	24D84115B03	8-1/2 turns; tapped; coded ORG: includes tuning core (coded YEL)
L102	24D84115B02	8-1/2 turns: coded RED: includes tuning core (coded YEL)
L103	24D84115B03	8-1/2 turns: tapped: coded ORG: includes tuning core (coded YEL)
L104	24D84115B13	8-1/2 turns: tapped: coded ORG: includes tuning core (coded YEL)
L105 thru L108	24D84113B07	4-1/2 turns; coded GRN: includes tuning core (coded ORG)
L109	24D84114B05	3-1/2 turns: coded BLUE: includes tuning core coded ORG (TLC6112B)
L109	24D84114B04	4-1/2 turns; coded YEL; includes tuning core coded ORG (TLC6112A)
L110, 111	24D84258B01	21 turns: coded BRN: includes tuning core (coded RED)
L112	24D84258B02	27 turns: tapped: coded RED: includes tuning core (coded RED)
L113	24D84258B01	21 turns: coded BRN: includes tuning core (coded RED)
L114	24D84258B03	40 turns: coded ORG: includes tuning core (note coded)
L120, 121	24C83961B01	choke: ferrite bead type
L123, 124	24D82135G10	choke: 100 uH
L125, 126	24D82835G26	choke: 71 uH
L127	24D82135G10	choke: 100 uH
L128	24D82135G01	choke: 620 uH
		TRANSISTOR:
Q101	48R869494	N-P-N: type M9494
Q102	48R869651	field-effect: N-channel type M9651
Q103	48R869652	field-effect: N-channel type M9652
		RESISTOR, fixed: ±5%; 1/4 W: unl. stated
R101	6S129232	3.9k ±10%
R102	6S127806	27k ±10%
R103	6S124A60	3k
R104	6-124A13	33
R105	6-124A13	33 (TLC6112A only)
R106	6S131652	39 ±10%
R107	6S129753	100 ±10%
R108	6-124A59	2.7k (TLC6112A)
R108	6-124A49	1k (TLC6112B)
R109	6-124A27	120 (TLC6112A)
R109	6-129806	330 (TLC6112B)
R110	6S129862	150 ±10%
R111	6S131652	39 ±10%
R112	6S129236	15k
R113	6S129236	15k
R114	6S124A23	82
R115	6S129236	15k
R116	6S129707	2.7k
R117	6S129526	33k
R118	6S128777	39k
R119	6S129707	2.7k
R120	6S129818	820
R121	6S129667	22k
R122	6S129804	2.2k
R123	6S129755	10 ±10%
R124	6S129526	33k
R125	6S129886	27k
R126	6S131526	18k
R127	6S128684	56k ±10%
		CRYSTAL UNIT, quartz:
Y101	48D84259B01	i-f filter
Y102	48D84259B02	i-f filter
Y103	48D84259B01	i-f filter
Y104	48D84259B03	i-f filter
Y105	48D84259B03	i-f filter
Y106	48D84104B01	discriminator

Mechanical Parts L[illegible]
TLB6850A & TLC6110A Series

CODE	MOTOROLA PART NO.	DESCRIPTION
1	55B84300B03	HANDLE
2	3S134212	LOCKSCREW, tapping 4-40 x 5/16" "Phillips" hex [illegible]
3	26B84242B01	[illegible]
4	26B84244B01	S[illegible]
5	26C84689B01	SHIELD
6	5B84220B01	GROMMET, nylon
7	55B84300B02	HANDLE
8	42C82484B01	RETAINER, screw (8 req'd)
9	3S136905	LOCKSCREW, tapping 4-40 x 5/16" "Phillips" round head (8 req'd)
10	26B84253B01	SHIELD
11	26B84250B04	CAN, square (staked)
12	26C83838F01	SPRING, retainer
13	7B84264B01	BRACKET, lamp holder
14	29S10434A23	RECEPTACLE, female [illegible]
15	29C84028H01	[illegible]
16	26B84248B01	[illegible]
17	29K855943	[illegible]
18	26B84248B02	[illegible]
19	26B84250B03	[illegible]
20	26B84250B01	[illegible]
21	26B84250B02	[illegible]
22	14A84503B01	[illegible]
23	4A49854	[illegible]

REVISIONS 68P81026E36-D

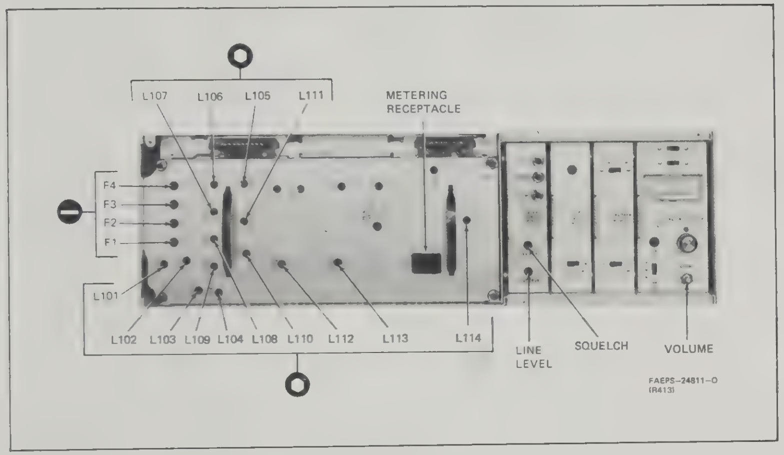
CHASSIS & SUFFIX NO.	REF SYMBOL	CHANGE	POSITION
TLC6112A & TLC6112B	IC101 & 102	FROM [illegible] TO 51-84561L69	2ND & 3RD I-F AMPLIFIER

A. FREQUENCY CALCULATIONS

$$f_o = \frac{f_c + 5.26\ \text{MHz}}{6}$$

Where: f_o = channel element frequency
f_c = rf carrier frequency
6 = channel element harmonic
5.26 = mixer output frequency (i-f)

B. ADJUSTMENT LOCATIONS



C. TYPICAL RECEIVER METER READINGS

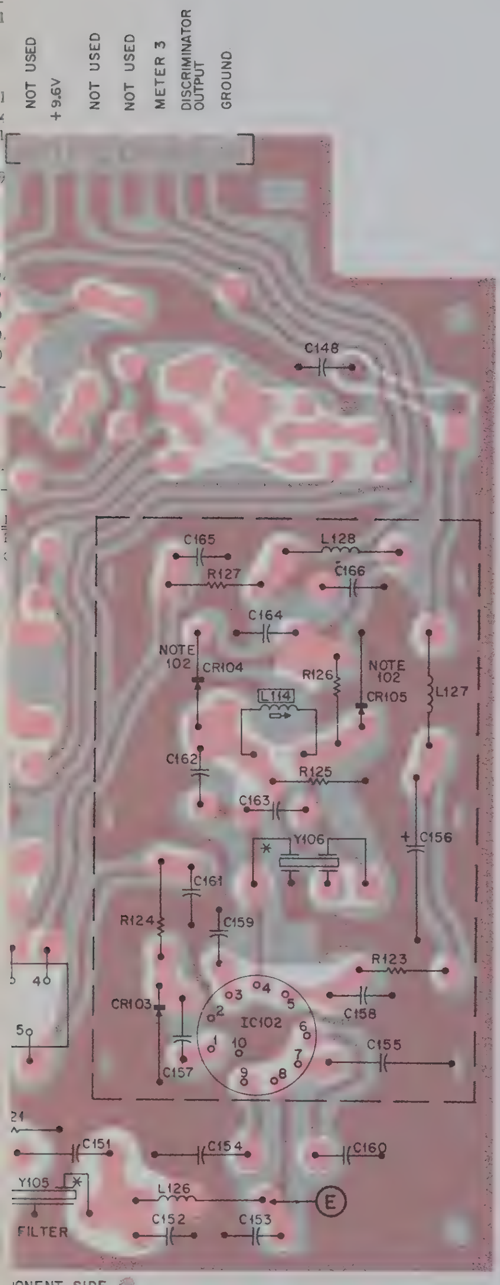
(No Signal Input)

Meter Switch Position	Reading (uA)	Circuit Metered
3	18 min.	Channel Element Output (TLC6112A)
	18 min.	Channel Element Output (TLC6112B)
4	0 ±2	Discriminator Output
5	2 to 10	3rd I-F Amplifier and Limiter

D. ALIGNMENT PROCEDURE

Step	Adjust	Selector Switch Position		Osc. & Meter Rev.	Stage and Procedure
		Portable Test Set	Optional Built-In Receiver Metering		
1	L101,L102	3	3	Meter Rev.	CHANNEL ELEMENT OUTPUT — If coils have been completely misaligned or the frequency is being changed, pre-position the coil slugs flush with the board. Adjust L101 and L102 for a peak indication on meter 3.
2	L103,L104	3	3	Meter Rev.	INJECTION AMPLIFIER OUTPUT — Adjust L103 for a dip and L104 for a peak on meter position 3. Repeat alignment procedure step 1.
3		*	6	A or B (Test Set must be equipped with 5.26 MHz crystal in corresponding socket)	DISCRIMINATOR — Unsquelch the receiver by turning the squelch control fully counterclockwise. *Private-Line* stations must also be PL disabled. Note meter reading. Insert 5.26 MHz ±100 Hz signal (from portable test set, or similar high accuracy generator) into L113 opening of receiver shield being careful not to contact circuit board. Insert probe into hole far enough to obtain reading lower than 1/10 of that noted at beginning of this step (signal is "sprayed" into radio).
	L114	4	4		Adjust L114 for 0 center reading. Adjustment is critical and should be *exactly* on 0. Remove probe.
4	L110, L111, L112, L113	5	5	Meter Rev.	INTERMEDIATE FREQUENCY — If the i-f has been completely misaligned, pre-position slugs approximately 1/4 inch from the board, otherwise, proceed as follows. Connect a signal generator to the antenna input and apply and carefully maintain an on-frequency signal sufficient for an indication of about 20 microamperes on meter position 5. Peak L110 thru L113. Lower signal generator output level while peaking these coils to maintain a meter 5 indication between 20 and 30 microamperes. Repeat.
5	L105, L106, L107, L108, L109	5	5	Meter Rev.	RF PRESELECTOR — If the preselector has been completely misaligned or the frequency is being changed, pre-position the slugs to the bottom of the preselector cans (flush with the board). Connect a signal generator to the antenna input and apply and carefully maintain an on-frequency signal sufficient for an indication of about 20 microamperes on meter 5. Peak L105 thru L109. Lower signal generator output level while peaking these coils to maintain a meter 5 indication between 20 and 30 microamperes. Repeat.
6	L103, L104, L109, L110	5	5	Meter Rev.	INJECTION AMPLIFIER OUTPUT — Adjust L103, L104, L109, and L110 for a peak on meter position 5. Repeat.
7	F1	5	5	Meter Rev.	ON-FREQUENCY ADJUSTMENT — Disconnect signal generator and transmit carrier signal from transmitter normally received. If transmitter is known to be on frequency, meter 5 should indicate a rise when transmitter is keyed (if necessary, connect an antenna to the station). Check position 4 reading with transmitter keyed. A "0" indicates an on-frequency condition. Adjust F1 *receiver* warp capacitor for exact 0 reading. DO NOT READJUST L101 OR L102 AFTER THESE ADJUSTMENTS ARE MADE.
8	—	—	—		Perform 20 dB quieting sensitivity measurement as check of alignment.

* If the portable test set is used, connect an ac voltmeter across pins 1 and 18 of the audio control module for this reading.


NOT USED
+9.6V
NOT USED
NOT USED
METER 3
DISCRIMINATOR OUTPUT
GROUND
C148
C165
L128
R127
C166
C164
NOTE 102
CR104
R126
NOTE 102
CR105
L114
L127
C162
R125
C163
Y106
C156
C161
R124
C159
R123
CR103
IC102
C158
C155
C157
C151
C154
C160
Y105
L126
E
C152
C153
FILTER

'ONENT SIDE ●
ER SIDE ●

OL-EEPS-8654-E

MOTOROLA INC.
Communications
Sector

LINK RECEIVER OPTIONS

C661___ OPTION SERIES

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MICOR SENSITRON **MID-BAND RECEIVER RF & I-F BOARD** 68P81026E36

RECEIVER INTERCONNECT BOARD 68P81026E72

RECEIVER FLAT AUDIO BOARD 68P81063E12

CABLE KITS 68P81063E13

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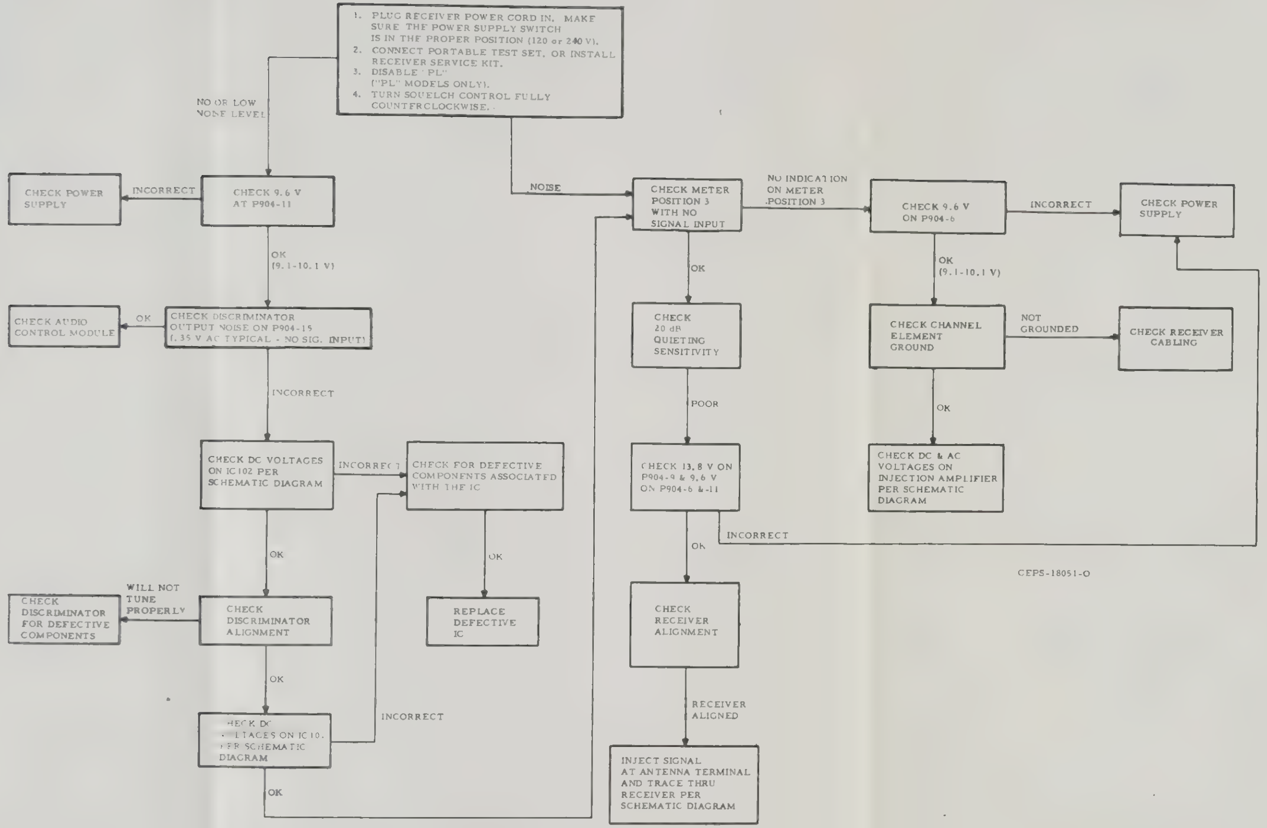
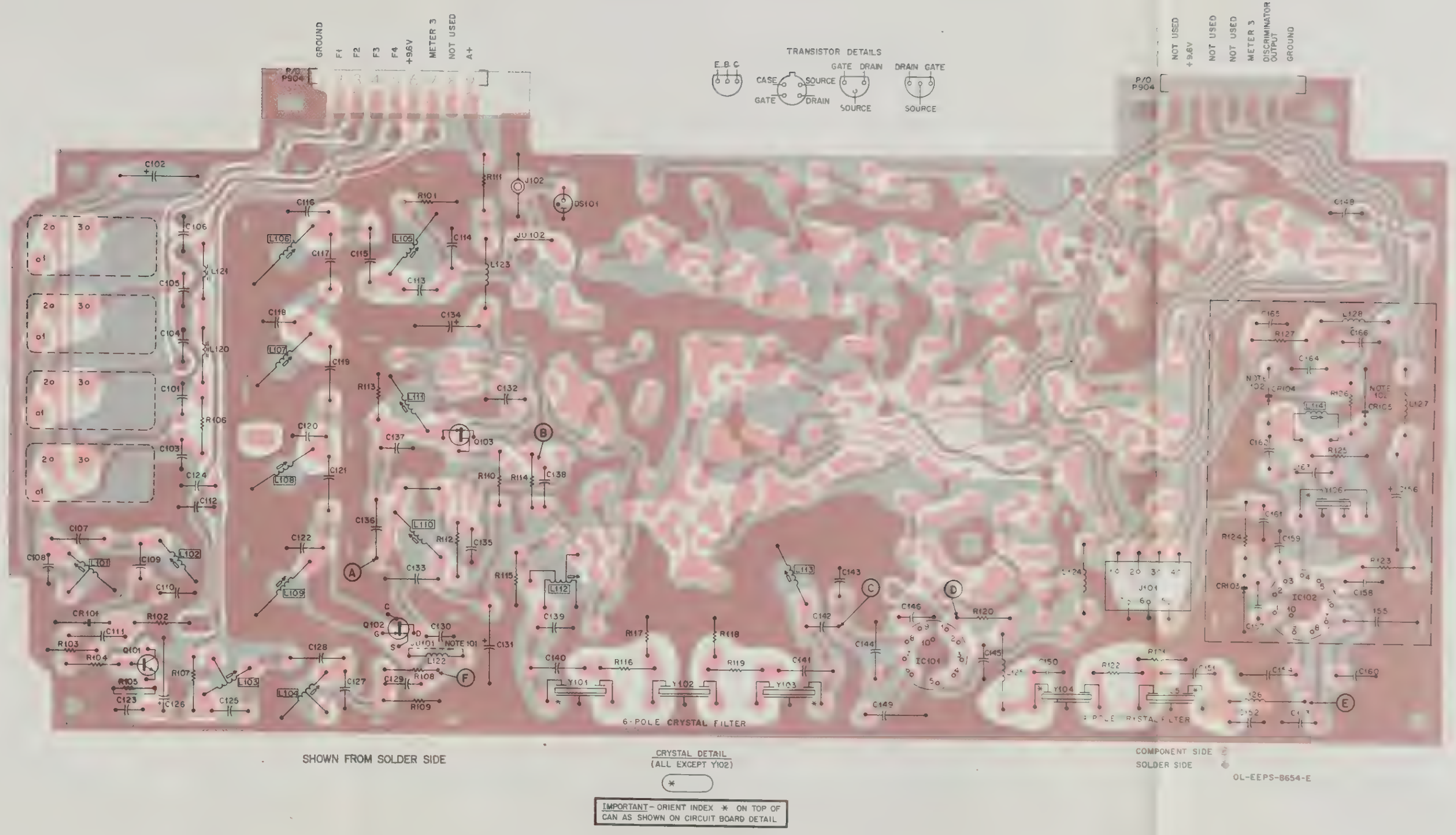
1301 E. Algonquin Road, Schaumburg, Il. 60196

TROUBLESHOOTING CHART


1. PLUG RECEIVER POWER CORD IN. MAKE SURE THE POWER SUPPLY SWITCH IS IN THE PROPER POSITION (120 or 240 V).
2. CONNECT PORTABLE TEST SET, OR INSTALL RECEIVER SERVICE KIT.
3. DISABLE "PL" ("PL" MODELS ONLY).
4. TURN SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
NO OR LOW NOISE LEVEL
NOISE
CHECK POWER SUPPLY
INCORRECT
CHECK 9.6 V AT P904-11
OK (9.1-10.1 V)
CHECK AUDIO CONTROL MODULE
OK
CHECK DISCRIMINATOR OUTPUT NOISE ON P904-15 (.35 V AC TYPICAL - NO SIG. INPUT)
INCORRECT
CHECK DC VOLTAGES ON IC102 PER SCHEMATIC DIAGRAM
INCORRECT
CHECK FOR DEFECTIVE COMPONENTS ASSOCIATED WITH THE IC
OK
REPLACE DEFECTIVE IC
OK
CHECK DISCRIMINATOR FOR DEFECTIVE COMPONENTS
WILL NOT TUNE PROPERLY
CHECK DISCRIMINATOR ALIGNMENT
OK
CHECK DC VOLTAGES ON IC10 PER SCHEMATIC DIAGRAM
INCORRECT
OK
CHECK METER POSITION 3 WITH NO SIGNAL INPUT
NO INDICATION ON METER POSITION 3
CHECK 9.6 V ON P904-6
INCORRECT
CHECK POWER SUPPLY
OK (9.1-10.1 V)
CHECK CHANNEL ELEMENT GROUND
NOT GROUNDED
CHECK RECEIVER CABLING
OK
CHECK DC & AC VOLTAGES ON INJECTION AMPLIFIER PER SCHEMATIC DIAGRAM
OK
CHECK 20 dB QUIETING SENSITIVITY
POOR
CHECK 13.8 V ON P904-9 & 9.6 V ON P904-6 & -11
INCORRECT
OK
CHECK RECEIVER ALIGNMENT
RECEIVER ALIGNED
INJECT SIGNAL AT ANTENNA TERMINAL AND TRACE THRU RECEIVER PER SCHEMATIC DIAGRAM
CEPS-18051-O


GROUND
F1
F2
F3
F4
+9.6V
METER 3
NOT USED
A+
P/O P904
TRANSISTOR DETAILS
E B C
CASE
SOURCE
GATE
DRAIN
GATE DRAIN
SOURCE
DRAIN GATE
SOURCE
NOT USED
+9.6V
NOT USED
NOT USED
METER 3
DISCRIMINATOR OUTPUT
GROUND
P/O P904
Q101
Q102
Q103
J101
J102
IC101
IC102
Y101
Y102
Y103
Y104
6-POLE CRYSTAL FILTER
CRYSTAL FILTER
A
B
C
D
E
F
SHOWN FROM SOLDER SIDE
CRYSTAL DETAIL (ALL EXCEPT Y102)
*
IMPORTANT- ORIENT INDEX * ON TOP OF CAN AS SHOWN ON CIRCUIT BOARD DETAIL
COMPONENT SIDE
SOLDER SIDE
OL-EEPS-8654-E

Receiver Circuit Board Detail and Troubleshooting Chart
Motorola No. PEPS-17906-B
10/8/82- PH1

MOTOROLA INC.
Communications
Sector

LINK RECEIVER OPTIONS

C661__ __ OPTION SERIES

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technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, the applicable schematic diagrams are updated.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 900 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications and Electronics, Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Group products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender" ® and "Vibrasponder" ® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, PROMs, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, PROMs, code plugs, *Vibrasender* and *Vibrasponder* resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used; and should include any serial numbers stamped on the components being replaced.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and
Electronics Inc.
Communications & Electronics Parts
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60196
Phone: 312-576-3900

5.2 U.S. ORDERS

WESTERN AREA PARTS
1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS
1313 E. Algonquin Road
Schaumburg, Ill. 60196
Phone: 312-576-7430
TWX: 910-693-0869

MID-ATLANTIC AREA PARTS
7230 Parkway Drive
Hanover, Maryland 20176
Phone: 301-796-8763
TWX: 710-862-1941

EAST CENTRAL AREA PARTS
12995 Snow Road,
Parma, Ohio 44130
Phone: 216-433-1560
TWX: 810-421-8845

EASTERN AREA PARTS
85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-444-9662
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS
P.O. Box 85036
San Diego, California 92138
Phone: 714-578-8030
TWX: 910-335-1516

GULF STATES AREA PARTS
1140 Cypress Station
P.O. Box 73115
Houston, Texas 77090
Phone: 713-537-3636
TWX: 910-881-6392

SOUTHWESTERN AREA PARTS
P.O. Box 34290
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-620-8511
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS
P.O. Box 368
Decatur, Georgia 30031
Phone: 504-987-2232
TWX: 810-766-0876

5.3 CANADIAN ORDERS

MOTOROLA LTD.
National Parts Department
3125 Steeles Avenue East
Willowdale, Ontario M2H 2H6
Phone: 416-499-1441
TWX: 610-491-1032
Telex: 06-526258

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC.
International Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196 U.S.A.
Phone: 312-576-6492
TWX: 910-693-0869
Telex: 722443
Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS, PROMs, AND RESONANT REED ORDERS

ALL MAIL ORDERS
Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

CORRESPONDENCE
Motorola, Inc.
Component Products Sales & Service
2553 N. Edgington Street
Franklin Park, Illinois 60131
Phone: 312-451-1297
TWX: 910-227-0799
Telex: 433-0067

MOTOROLA INC.
Communications
Group

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

> DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.
>
> DO NOT operate the transmitter of a fixed radio (base station, microwave and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.
>
> DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

> DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.
>
> All equipment must be properly grounded according to Motorola installation instructions for safe operation.
>
> All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

EPS-28750-O

WARNING

For vehicles equipped with electronic anti-skid braking systems see "ANTI-SKID BRAKING PRECAUTIONS" Publication, Motorola Number 68P81109E34.

LINK RECEIVER OPTIONS CHART

C661__ __ SERIES

(72-76 MHz)

CODE:

● = INDICATES ITEM ADDED BY OPTION
○ = INDICATES ITEM DELETED BY OPTION
★ = INDICATES ITEM INCLUDED AS PART OF TRC1052AB RECEIVER

OPTION NUMBER	C661AA	C661AB	C661AC	C661AD	C661AF	KIT NUMBER	KIT NAME	REFERENCES FOR ADDED ITEMS
APPLICABLE MODELS	LOW BAND LOW POWER (C71 SERIES)	LOW BAND AND HIGH BAND HIGH POWER (B91 AND C93 SERIES)	UHF BAND LOW POWER (C64 SERIES)	HIGH BAND LOW POWER (C73 SERIES)	UHF BAND HIGH POWER (B84 SERIES)			
	●	●	●	●	●	K1003A	RECEIVER CHANNEL ELEMENT	NONE REQUIRED
	●	★		●		TKN6570A	RF CABLE ASSEMBLY, RECEIVER	THIS MANUAL
		●				TKN6707A	REPEATER CABLE	STATION MANUAL
		○				TKN6733A	TRANSMITTER ONLY CABLE	
	●			●		TKN6885A	REPEATER CABLE	STATION MANUAL
	○			○		TKN6918A	RECEIVER CABLE	
			●		●	TKN8269A	RF CABLE ASSEMBLY, RECEIVER	THIS MANUAL
	●	●	●	●	●	TKN8307A	LINK RECEIVER CABLE	THIS MANUAL
	●	★	●	●	●	TLC6112B	RF & IF BOARD	THIS MANUAL
		●				TLN1435B	RECEIVER SHIELD AND FILTER	STATION MANUAL
		★				TLN4290B	AUDIO POWER AMPLIFIER	STATION MANUAL
		★				TLN4726B	RECEIVER INTERCONNECT BOARD	THIS MANUAL
		★				TLN4755A	RECEIVER CHASSIS & HARDWARE	THIS MANUAL
		●				TLN5168A	RECEIVER METERING & SWITCH	STATION MANUAL
	●		●	●	●	TLN5654A	*DIGITAL PRIVATE-LINE* DECODER HARDWARE	STATION MANUAL
	●	●	●	●	●	TLN5729A	*DIGITAL PRIVATE-LINE* DECODER	STATION MANUAL
				○		TLN5903A	RECEIVER SHIELD	
			●	●	●	TLN5914A	RECEIVER SHIELD	NONE REQUIRED
		●				TRC1052AB	RECEIVER, 72-76 MHz	NONE REQUIRED
			○			TRN5117A	HARDWARE KIT	
					○	TRN5118A	HARDWARE KIT	
				○		TRN5342A	HARDWARE KIT	
	●	●	●	●	●	TRN5348A	TRANSMITTER FLAT AUDIO BOARD	CONTROL MANUAL
	●	●	●	●	●	TRN5363A	RECEIVER FLAT AUDIO BOARD	THIS MANUAL
		●				TRN5451A	TRANSMITTER FLAT AUDIO HARDWARE KIT	CONTROL MANUAL
	●		●	●	●	TRN5485A	HARDWARE KIT	STATION MANUAL
		●				TRN6001A	HARDWARE KIT	STATION MANUAL
	●	●	●	●	●	TRN6005A	HYBRID CODE PLUG	NONE REQUIRED
			○	○	○	TRN6006A	10 W AUDIO SQUELCH BOARD	
	○					TRN6007A	10 W AUDIO SQUELCH BOARD	
	●		●	●	●	TRN6188A	*DIGITAL PRIVATE-LINE* ENCODER HARDWARE	STATION MANUAL
			○		○	TRN6194A	RECEIVER SHIELD	

EPS-35324-O

SYSTEM INFORMATION

1. DESCRIPTION

The C661__ __ Series options add 72-76 MHz link receivers to base/repeater stations. This manual contains servicing information for added kits that are not covered in the station and control manuals that are supplied with the station.

Refer to the options chart in the front of this manual to determine which kits are added to or deleted from your station. The options chart also refers the serviceman to the applicable service manual for each kit.

2. INSTALLATION

2.1 INTRODUCTION

Install the equipment as described in the station and control manuals supplied with the station. Perform the alignment procedures for the transmitter(s) and receiver(s) in the station; the alignment procedure for link receivers supplied as part of the C661 option is contained in this manual. Perform level setting adjustments for the equipment in the control section of the station. Remove or add jumpers to the modules in the control section as directed in the control manual supplied with the station. The addition of the link receiver option requires additional changes to the jumper configurations; refer to the Jumper Configurations paragraph of this section.

2.2 JUMPER CONFIGURATIONS

2.2.1 Receive Audio and Squelch Board (TRN5363A)

Jumper	Carrier Squelch	*Private-Line* Squelch	*Digital Private-Line* Squelch
JU201	IN	OUT	IN
JU202	OUT	OUT	OUT
JU203	IN*	IN*	IN*
JU204	IN	IN**	IN**

* IN for low audio.
** OUT for "and squelch".

2.2.2 Remote Control Board

2.2.2.1 Non-unified Board

Step 1. Connect TB1-1 (REC +) to TB1-3 (TRANS +).

Step 2. Connect TB1-2 (REC −) to TB1-5 (TRANS −).

2.2.2.2 Unified Board

Step 1. Connect TB1-4 (REC +) to TB1-1 (TRANS +).

Step 2. Connect TB1-6 (REC −) to TB1-3 (TRANS −).

2.2.3 Guard Tone Decoder Module (TRN2376A)

Remove resistor R91 (11k) on solder side of board.

3. RECEIVE AUDIO LEVEL ADJUSTMENT

NOTE

This procedure should not be performed until the jumpers are installed on the remote control board, as described above, and the receiver is aligned.

Step 1. Set receiver squelch control (on audio control module) fully counterclockwise (unsquelched). The coded squelch function in *Digital Private-Line* squelch equipped stations should be disabled (PL DISABLE).

Step 2. Connect an rf signal generator to receiver rf jack J103. Adjust generator output signal for a level of 1000 uV rms modulated with a test tone of 1000 Hz at ± 3 kHz deviation.

Step 3. Adjust line level control R203 on receiver audio and squelch board for a level of 150 mV rms as measured at J903-7 on the receiver interconnect board.

Step 4. Adjust output level control R9 on line driver module for a level of 0 dBm (reference 100mW at 600 ohms) at TB1-1, -2 on remote control board (REC +, REC –).

NOTE

Do not remove test equipment; continue to apply test tone to receiver rf jack for transmitter level setting described in the following.

4. TRANSMIT AUDIO LEVEL SETTING

Step 1. Verify that a level of 0 dBm (reference 100 mW at 600 ohms) is present at TB1-1, -2 (as described in receive audio level setting procedure).

Step 2. Adjust exciter level control R39 (on line driver module) for an exciter deviation of ± 3 kHz.

Step 3. Disconnect and remove all test equipment from station.

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MICOR SENSITRON MID-BAND RECEIVER RF & I-F BOARD

MODELS TLC6112A & TLC6112B
72-76 MHz

TECHNICAL CHARACTERISTICS

Input Impedance		50 ohms
RF Frequency Range		72-76 MHz
Channel Spacing		20 kHz
Selectivity EIA SINAD*		−100 dB @ ±20 kHz
Intermodulation EIA SINAD*		−80 dB
Modulation Acceptance EIA		±7 kHz
Sensitivity	20 dB Quieting	.5 microvolt or less (1.5 uV at local speaker with flat audio)
	EIA SINAD*	.35 microvolt or less
Oscillator (Channel Element) Stability		Channel element maintains oscillator frequency within ±.0005% of reference frequency from −30 °C to +60 °C ambient (+25 °C reference). Channel elements with frequency stability of ±.0002% are also available.
Spurious & Image Rejection		−100 dB minimum (TLC6112A) (−90 dB with flat audio) −90 dB minimum (TLC6112B)
Power Requirements		Regulated 9.1 to 10.1 volts dc @70 mA. +13.8 volts dc @12 mA.
Construction		Fully solid-state, two integrated circuits
Receiver Type		FM, superheterodyne, single conversion
Intermediate Frequency		5.26 MHz
Crystal Filter Type		Dual resonator, mode coupled, monolithic crystals
Metering		Three test points critical to operation and alignment are accessible at a metering receptacle which permits testing with a Motorola portable test set or any 50 microampere meter with 2000 ohms equivalent series resistance. Built-in service metering also available.

* EIA SINAD does not apply for receivers with flat audio. The following specifications apply for flat audio.

Selectivity	−90 dB @ ±20 kHz
Intermodulation	−75 dB
20 dB Quieting	1.5 microvolts at local speaker.

1. DESCRIPTION

1.1 This fully solid-state receiver rf and i-f circuit board incorporates two integrated circuits, two i-f crystal filters, three transistors, plug-in channel elements, and a crystal discriminator.

1.2 All circuits are constructed on a single plug-in circuit board which is easily removed and replaced. All external dc and audio connections are made at a single row of pins which eliminate interconnecting wires; rf input is provided by a single plug-in coaxial cable. Circuit board plating is on both sides of the board with all components mounted on the back side. All alignment points are accessible from the front of the station.

1.3 This board produces a low-noise audio signal from an ''on-channel'' frequency modulated rf carrier.

2. CIRCUIT ANALYSIS

This receiver board is a highly selective, crystal-controlled, single conversion FM receiver (less audio amplifier, squelch circuitry and speaker). Bandwidth and selectivity characteristics are determined by rf preselector coils and i-f crystal filters. Plug-in crystal oscillator modules (channel elements) provide stable frequency control. Highly reliable integrated circuits are used for all i-f amplification and limiting after the first crystal filter section. A crystal discriminator is used to provide high audio recovery from the i-f signal. Refer to schematic diagram for more circuit details.

3. MAINTENANCE

This section of the manual provides the maintenance procedures for the receiver rf and i-f section of the station. These tests include metering measurements and procedures for testing and troubleshooting, including integrated circuit check-out.

NOTE

The receiver rf and i-f board must be installed in the receiver for testing to provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stations of the receiver.

3.1 20 dB QUIETING SENSITIVITY TEST

3.1.1 This performance test may be used after repair and alignment to assure that the receiver meets all specifications before it is returned to service.

3.1.2 It may be performed using optional built-in receiver metering or a Motorola S-1056B thru S-1059B Series Portable Test Set. J101 can accommodate only the built-in metering set or the portable test set, but not both simultaneously. Plugging a portable test set in a receiver that has built-in metering will disconnect the built-in metering cable.

NOTE

The receiver shield must be in place while performing this test.

Step 1. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. *Private-Line* receivers must also be PL disabled.

Step 2. (Optional built-in receiver metering only.) Set the meter selector switch to position 6 and the speaker switch to the OFF position. Adjust the LINE LEVEL control for 50 uA as indicated on the meter.

Step 3. (Portable test set only.) If a portable test set is used, an ac voltmeter is required. Connect an ac voltmeter across pins 1 and 18 of the audio control module. Adjust the line level control so the ac voltmeter reads 565 mV ac.

Step 4. Connect a signal generator to the station antenna receptacle and adjust it to the receiver frequency. Set the rf output to minimum.

Step 5. Increase the signal generator output until the meter reading drops to 1/10 of the value in Step 2 or Step 3. The generator output level now indicates the 20 dB quieting sensitivity and should be .35 microvolt, or less (1.5 microvolts or less for flat audio receivers).

Step 6. Readjust the LINE LEVEL pot as described in the MAINTENANCE section in the front of the manual.

3.2 TROUBLESHOOTING

3.2.1 Circuit Measurements

3.2.1.1 General

3.2.1.1.1 A failure in almost any part of the rf and i-f section will produce an improper meter reading on one or more of the test points. Improper alignment will also cause improper meter readings.

3.2.1.1.2 A "0" meter reading in position 3 or 5 indicates either: (1) insufficient drive from a preceding stage or; (2) a defective component at the metering point.

3.2.1.2 Procedure

Step 1. (Portable test set only.) Connect the 20-pin plug of the adapter cable to the test set. When the test set is not in use, disconnect the 20-pin plug to conserve test set battery life. The plug acts as an on-off switch completing the battery circuit.

Step 2. (Portable test set only.) Connect the white "metering" plug of the adapter cable to the metering receptacle on the receiver rf and i-f circuit board.

Step 3. Compare the current readings in SELECTOR SWITCH positions 3, 4 and 5 with those in the following table. A low reading on meter position 3 indicates a defective channel element or multiplier circuit. An improper meter reading in position 4 or 5 readings indicate a malfunction elsewhere in the receiver, which can most rapidly be found by checking rf and i-f voltages, per the schematic diagram.

3.2.2 Alignment as a Troubleshooting Aid

Low test set readings, improper discriminator output, and otherwise abnormal performance are very often corrected by realignment. Therefore, alignment should be the first step performed for these symptoms. Many technicians prefer to use alignment as the first troubleshooting step in all cases.

Typical Receiver RF & I-F Meter Readings Table
(No Input Signal Applied)

Selector Switch Position	Meter Reading (uA)	Circuit Metered)
3	25 min.	Channel Element Output (TLC6112A)
	18 min.	Channel Element Output (TLC6112B)
4	0 ± 2	Discriminator Output
5	2 to 10	3rd I-F Amplifier and Limiter

3.2.3 Isolating Defective Components

If test set readings are abnormal or other tests indicate abnormal performance, a troubleshooting procedure is desirable to isolate the defective component. The troubleshooting chart summarizes troubleshooting in a logical sequence. Normal rf voltages through the receiver are shown on the schematic diagram. These voltage readings are typical and can vary as much as 2 to 1 in a normal receiver because of an accumulation of small differences in gain or insertion loss of preceding circuitry. A few voltage and resistance checks in the suspected circuit should readily isolate the defective component.

3.2.4 Troubleshooting Integrated Circuits

3.2.4.1 The IC's in the receiver i-f section may be checked by dc voltage measurements. Proper voltages are shown on the schematic diagram and in the tables that accompany the schematic diagram.

3.2.4.2 For several of the dc voltages the absolute value is not so important as is the relationship of one voltage to another. These relationships are clearly shown on the schematic diagram and the accompanying tables.

NOTE

To measure dc voltages on IC102, the discriminator shield (solder side of board) must be removed. This cover must be replaced to take meter and gain measurements after repairs have been completed.

3.2.5 Troubleshooting Crystals

3.2.5.1 A defective filter can best be found by measuring the rf voltages at the various points in the i-f section as indicated in the schematic diagram and Receiver RF Voltage Table. A defective crystal will show an abnormally high insertion loss. Before making the check, verify, using an ohmmeter, that the center pins of all five filter crystals are connected to the associated crystal case. The resistance between the center pin and the case should be less than 1 ohm. The loss of this ground may cause errors in gain measurements because of the loss of shielding effectiveness.

3.2.5.2 Before replacing the discriminator crystal, verify that all components associated with the discriminator circuitry are not defective. Also, verify, in a manner similar to that used for the filter crystals, that pin 2 is connected (less than 0.1 ohm) to the crystal case.

NOTE

When discriminator or filter crystals are replaced (except for Y102), they must be physically oriented so that the index asterisk on the top of the filter can is as shown on the schematic diagram or circuit board detail. The crystals are built to match specific input and output impedances and will not perform satisfactorily if reversed. Y102, if replaced, may be oriented in either direction.

MOTOROLA INC.

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81063E10-0 Link Receiver Options Instruction Manual

REVISION DETAILS:

LINK RECEIVER OPTIONS CHART

Option number C661AF should be C661AE.

TLN5729A *Digital Private-Line* Decoder is replaced by TRN5768A *Digital Private-Line* Decoder. Reference to STATION MANUAL is replaced with THIS MANUAL.

An options chart (Motorola No. EPS-35823-0) for 450-470 MHz Link Receivers is attached and should be added to your manual.

An options chart (Motorola No. EPS-36028-0) for 928-960 MHz Link Receivers is attached and should be added to your manual.

DESCRIPTION SECTION, 68P81063E11-0

The first paragraph under heading 1. **DESCRIPTION** should read:

The C661__ Series options add 72-76 MHz link receivers to base/repeater stations. The C659__ Series options add 450-470 MHz link receivers with carrier squelch to base/repeater stations. The C662__ Series options add 450-470 MHz link receivers with *Digital Private-Line* squelch to base/repeater stations. The C660__ Series options add 928-960 MHz link receivers with carrier squelch to base/repeater stations. The C663__ Series options add 928-960 MHz link receivers with *Digital Private-Line* squelch to base/repeater stations. This manual contains servicing information for added kits that are not covered in the station and control manuals that are supplied with the station.

Paragraph 2.2.1 should read:

2.2.1 Receive Audio and Squelch Board (TRN5363A and TRN5716A)

Jumper	**Carrier Squelch**	***Digital Private-Line* Squelch**
JU201	IN	IN
JU202	OUT	OUT
JU203	IN*	IN*
JU204	IN	IN**

*IN for low audio.
**OUT for "AND SQUELCH".

CABLE KITS SECTION 68P81063E13-0

This section should be replaced with attached instruction section 68P81063E13-A.

In addition, the attachments listed below should be added as follows:

Safe Handling of CMOS Integrated Circuit Devices Instruction Section 68P81106E84-C should be inserted after the options chart.

TRN5768A *Digital Private-Line* Decoder section 68P81063E78-0 should be inserted after System Description section 68P81063E11-0.

Hardware Kits Instruction Section 68P81063E84-0 should be inserted at the end of the manual.

All other attachments should be placed immediately behind *Micor Sensitron* Mid-Band Receiver RF and I-F Board section 68P81026E36. These attachments contain servicing for kits that are added for 450-470 MHz link receivers, except section 68P81063E26-0 which contains servicing information specifically for 928-960 MHz link receivers.

ATTACHMENTS;

Link Receiver Options Charts (C659__ and C662__ Series)	EPS-35823-0
Link Receiver Options Charts (C660__ and C663__ Series)	EPS-36028-0
Safe Handling of CMOS Integrated Circuit Devices	68P81106E84-C
TRN5768A *Digital Private-Line* Decoder Instruction Section	68P81063E78-0
TRE1333A Link Receiver Instruction Section	68P81063E79-0

TKN8861A Receiver Meter Kit Schematic Diagram and Parts List..PEPS-35862-0
TRE1242A Receiver Instruction Section..............................68P81063E81-0
TRN5716A Flat Audio and Squelch Board Instruction Section.........68P81063E83-0
TRF1032A *Micor Sensitron* Receiver RF and I-F Board Instruction Section...68P81063E26-0
Cable Kits Instruction Section.....................................68P81063E13-A
Hardware Kits Instruction Section..................................68P81063E84-0

LINK RECEIVER OPTIONS CHART

C659____ SERIES

C662____ SERIES

(450-470 MHz)

CODE:

● = INDICATES ITEM ADDED BY OPTION

○ = INDICATES ITEM DELETED BY OPTION

★ = INDICATES ITEM INCLUDED AS PART OF TRE1333A

OPTION NUMBER

APPLICABLE MODELS

CARRIER SQUELCH MODELS					*DIGITAL PRIVATE-LINE* MODELS							
C659AA LOW BAND LOW POWER (C71 SERIES)	C659AB LOW BAND AND HIGH BAND HIGH POWER (B91 AND C93 SERIES)	C659AC UHF BAND LOW POWER (C64 SERIES)	C659AD HIGH BAND LOW POWER (C73 SERIES)	C659AE UHF BAND HIGH POWER (B84 SERIES)	C662AA LOW BAND LOW POWER (C71 SERIES)	C662AB LOW BAND AND HIGH BAND HIGH POWER (B91 AND C93 SERIES)	C662AC UHF BAND LOW POWER (C64 SERIES)	C662AD HIGH BAND LOW POWER (C73 SERIES)	C662AE UHF BAND HIGH POWER (B84 SERIES)	KIT NUMBER	KIT NAME	REFERENCES FOR ADDED ITEMS
●	●	●	●	●	●	●	●	●	●	KXN1024A	CHANNEL ELEMENT, RECEIVER	NONE REQUIRED
●	★		●		●	★		●		TKN8884A	RF CABLE ASSEMBLY, RECEIVER	NONE REQUIRED
	●					●				TKN6707A	CABLE, REPEATER	NONE REQUIRED
	○					○				TKN6733A	CABLE, TRANSMITTER ONLY	—
●			●		●			●		TKN6885A	CABLE, REPEATER	NONE REQUIRED
○			○		○			○		TKN6918A	CABLE, RECEIVER	—
		●		●			●		●	TKN8269A	RF CABLE ASSEMBLY, RECEIVER	THIS MANUAL
●	●	●	●	●	●	●	●	●	●	TKN8307A	CABLE, LINK RECEIVER	THIS MANUAL
	★					★				TKN8861A	RECEIVER METER KIT	THIS MANUAL
	●					●				TLN1435B	SHIELD AND FILTER, RECEIVER	STATION MANUAL
	★					★				TLN4290B	AUDIO POWER AMPLIFIER	STATION MANUAL
	★					★				TLN4726B	INTERCONNECT BOARD, RECEIVER	THIS MANUAL
					●		●	●	●	TLN5654A	*DIGITAL PRIVATE-LINE* DECODER HARDWARE	STATION MANUAL
					●	●	●	●	●	TLN5768A	*DIGITAL PRIVATE-LINE* DECODER	STATION MANUAL
			○					○		TLN5903A	SHIELD, RECEIVER	—
○					○					TLN5914A	SHIELD, RECEIVER	—
●	★	●	●	●	●	★	●	●	●	TRE1242A	RECEIVER, 450-470 MHz	THIS MANUAL
	●					●				TRE1333A	RECEIVER, LINK	THIS MANUAL
●	●	●	●	●	●	●	●	●	●	TRN5348B	TRANSMITTER FLAT AUDIO BOARD	CONTROL MANUAL
	●					●				TRN5451A	TRANSMITTER FLAT AUDIO HARDWARE KIT	NONE REQUIRED
●		●	●	●	●		●	●	●	TRN5662A	HARDWARE KIT, UHF LINK	NONE REQUIRED
	★					★				TRN5663A	HARDWARE KIT, RECEIVER AND CHASSIS	THIS MANUAL
●	★	●	●	●	●	★	●	●	●	TRN5716A	FLAT AUDIO AND SQUELCH BOARD	THIS MANUAL
					●	●	●	●	●	TRN6005A	HYBRID CODE PLUG	NONE REQUIRED
		○	○	○			○	○	○	TRN6006A	10 W AUDIO SQUELCH BOARD	—
○					○					TRN6007A	10 W AUDIO SQUELCH BOARD	—
					●		●	●	●	TRN6188A	*DIGITAL PRIVATE-LINE* ENCODER HARDWARE	STATION MANUAL
●			●		●			●		TRN6194A	SHIELD, RECEIVER	NONE REQUIRED
	●					●				TRN5750A	HARDWARE, LINK RECEIVER	THIS MANUAL

EPS-35823-O

LINK RECEIVER OPTIONS CHART

C660____ SERIES

C663____ SERIES

(928-960 MHz)

CODE:

● = INDICATES ITEM ADDED BY OPTION

○ = INDICATES ITEM DELETED BY OPTION

★ = INDICATES ITEM INCLUDED AS PART OF TRF1201A

OPTION NUMBER / APPLICABLE MODELS	C660AA	C660AB	C660AC	C660AD	C660AE	C660AF	C663AA	C663AB	C663AC	C663AD	C663AE	C663AF			
	CARRIER SQUELCH MODELS						*DIGITAL PRIVATE-LINE* MODELS								
	LOW BAND LOW POWER (C71 SERIES)	LOW BAND AND HIGH BAND HIGH POWER (B91 AND C93 SERIES)	UHF BAND LOW POWER (C64 SERIES)	HIGH BAND LOW POWER (C73 SERIES)	UHF BAND HIGH POWER (B84 SERIES)	900 MHz BAND HIGH POWER (C75 SERIES)	LOW BAND LOW POWER (C71 SERIES)	LOW BAND AND HIGH BAND POWER (B91 AND C93 SERIES)	UHF BAND LOW POWER (C64 SERIES)	HIGH BAND LOW POWER (C73 SERIES)	UHF BAND HIGH POWER (B84 SERIES)	900 MHz BAND HIGH POWER (C75 SERIES)	KIT NUMBER	KIT NAME	REFERENCES FOR ADDED ITEMS
	●	●	●	●	●	●	●	●	●	●	●	●	KXN1029A	CHANNEL ELEMENT, RECEIVER	NONE REQUIRED
	●		●	●	●	●	●		●	●	●	●	TKN8897A	CABLE, RECEIVER RF	THIS MANUAL
		●						●					TKN6707A	CABLE, REPEATER	NONE REQUIRED
		○						○					TKN6733A	CABLE, TRANSMITTER ONLY	—
				○						○			TKN6581A	CABLE, RF	—
	○						○						TKN6582A	CABLE, RF	—
	●		●	●	●	●	●		●	●	●	●	TKN8902A	CABLE ASSEMBLY, RECEIVER RF	THIS MANUAL
	●	●	●	●	●	●	●	●	●	●	●	●	TKN8307A	CABLE, LINK RECEIVER	THIS MANUAL
					○						○		TKN8004A	CABLE, LOW POWER BASE STATION	—
					●						●		TKN8908A	CABLE, LOW POWER LINK BASE STATION	THIS MANUAL
			○						○				TKN6804A	CABLE, 75 W	—
			●						●				TKN8905A	CABLE, 75 W LINK	THIS MANUAL
		★						★					TKN8861A	RECEIVER METER KIT	THIS MANUAL
		●						●					TLN1435B	SHIELD & FILTER, RECEIVER	STATION MANUAL
		★						★					TLN4290B	AUDIO POWER AMPLIFIER	STATION MANUAL
		★						★					TLN4726B	INTERCONNECT BOARD, RECEIVER	THIS MANUAL
	●		●	●	●	●	●		●	●	●	●	TRN5772A	SHIELD & INSERT, RECEIVER	NONE REQUIRED
	●		●	●	●		●		●	●	●		TLN5891A	SHIELD, RECEIVER (900 MHz)	NONE REQUIRED
			○		○				○		○		TRN6194A	SHIELD, RECEIVER (UHF)	—
				○						○			TLN5903A	SHIELD, RECEIVER (VHF)	—
	○						○						TLN5914A	SHIELD, RECEIVER (LOW BAND)	—
							●		●	●	●	●	TLN5654A	*DIGITAL PRIVATE-LINE* DECODER HARDWARE	STATION MANUAL
							●	●	●	●	●	●	TRN5768A	*DIGITAL PRIVATE-LINE* DECODER	STATION MANUAL
	●	★	●	●	●	●	●	★	●	●	●	●	TRF1032A	RECEIVER RF & I-F BOARD	THIS MANUAL
		●						●					TRF1201A	LINK RECEIVER (900 MHz)	THIS MANUAL
	●	●	●	●	●	●	●	●	●	●	●	●	TRN5348B	TRANSMITTER FLAT AUDIO BOARD	CONTROL MANUAL
		●						●					TRN5451A	TRANSMITTER FLAT AUDIO HARDWARE KIT	NONE REQUIRED
		★						★					TRN5792A	RECEIVER & CHASSIS HARDWARE	THIS MANUAL
	●	★	●	●	●	●	●	★	●	●	●	●	TRN5716A	FLAT AUDIO & SQUELCH BOARD	THIS MANUAL
							●	●	●	●	●	●	TRN6005A	HYBRID CODE PLUG	NONE REQUIRED
			○	○	○				○	○	○		TRN6006A	AUDIO SQUELCH BOARD (10 W)	—
	○						○						TRN6007A	AUDIO SQUELCH BOARD (10 W)	—
						○						○	TRN8406A	AUDIO SQUELCH BOARD (10 W)	—
							●		●	●	●	●	TRN6188A	*DIGITAL PRIVATE-LINE* ENCODER HARDWARE	STATION MANUAL
		●						●					TRN5791A	HARDWARE, LINK RECEIVER (900 MHz)	THIS MANUAL
		★						★					TKN8903A	CABLE, RECEIVER RF (900 MHz NON-UNIFIED)	THIS MANUAL

EPS-36028-O

MOTOROLA INC.
Communications
Sector

SAFE HANDLING OF CMOS INTEGRATED CIRCUIT DEVICES

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. *However, CMOS circuits can be damaged by improper handling of the modules even in a system.*

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions.

1. Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch *both* hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

NOTE

Wearing Conductive Wrist Strap (Motorola No. RSX-4015A) will minimize static buildup during servicing.

WARNING

When wearing Conductive Wrist Strap, be careful near sources of high voltage. The good ground provided by the wrist strap will also increase the danger of lethal shock from accidentially touching high voltage sources.

2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.

3. Normally, circuit modules can be inserted or removed with power applied to the unit. However, check the INSTALLATION and MAINTENANCE sections of the manual as well as the module schematic diagram to insure there are no objections to this practice.

4. When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

5. All electrically powered test equipment should be grounded. *Apply* the *ground lead* from the test equipment to the circuit module *before* connecting the *test probe*. Similarly, *disconnect* the *test probe prior* to removing the *ground lead.*

6. If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through 100k of resistance.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

7. When soldering, be sure the soldering iron is grounded.

8. Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

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1301 E. Algonquin Road, Schaumburg, Il. 60196

9. When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

10. All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

11. Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a simlar material (aluminum foil may be used). NEVER USE NON-CONDUCTIVE MATERIAL for packaging these modules.

parts

TRN5768A

REFER
SYM

C801
C802
C803
C804
C805
C806
C807
C808
C809
C810
C811

CR801, 8
CR803
CR804

Q801
Q802
Q803
Q804 thru
Q808
Q809, 81

R801
R802
R803
R804
R805
R806
R807
R808
R809
R810, 811
R813
R814
R815
R816
R817
R818
R819
R821
R822
R823
R824
R825
R826
R827
R828
R829
R830
R831

RT801
RT802

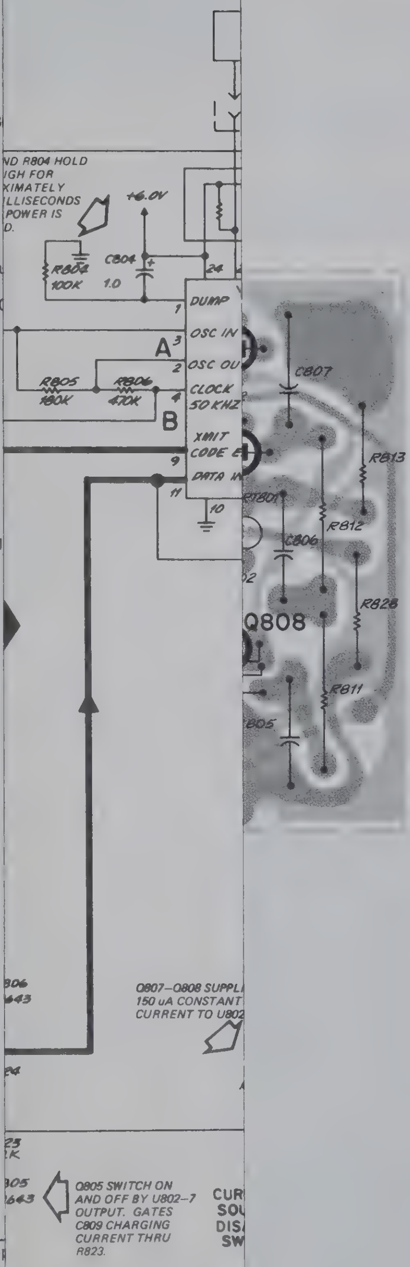
U801
U802

VR801
VR802

Y801

Z801

note: For o
be ordered b


ND R804 HOLD
IGH FOR
XIMATELY
LLISECONDS
POWER IS
D.
+6.0V
C804
1.0
R804
100K
24
7
DUMP
A
3
OSC IN
2
OSC OU
R805
180K
R806
470K
4
CLOCK
50 KHZ
B
XMIT
CODE E
9
DATA IN
11
10
C807
R813
RT801
R812
C806
R828
Q808
R811
C805
806
643
Q807–Q808 SUPPL
150 uA CONSTANT
CURRENT TO U802
24
23
K
305
643
Q805 SWITCH ON
AND OFF BY U802–7
OUTPUT. GATES
C809 CHARGING
CURRENT THRU
R823.
CUR
SOU
DIS
SW

DIGITAL PRIVATE-LINE DECODER

MODEL TRN5768A

FUNCTION

1. Decodes a 23-bit binary code word to unsquelch the receiver.

2. In radios with simplex *Digital Private-Line* operation, generates a 23-bit binary code word when the transmitter is keyed.

Technical Characteristics

Code Determining Device	TRN6005A Code Plug
Code Format	23-Bit Word
Code Frequency Spectrum	11-67 Hz
Output	Switched 5.3 V dc

9. When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

10. All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

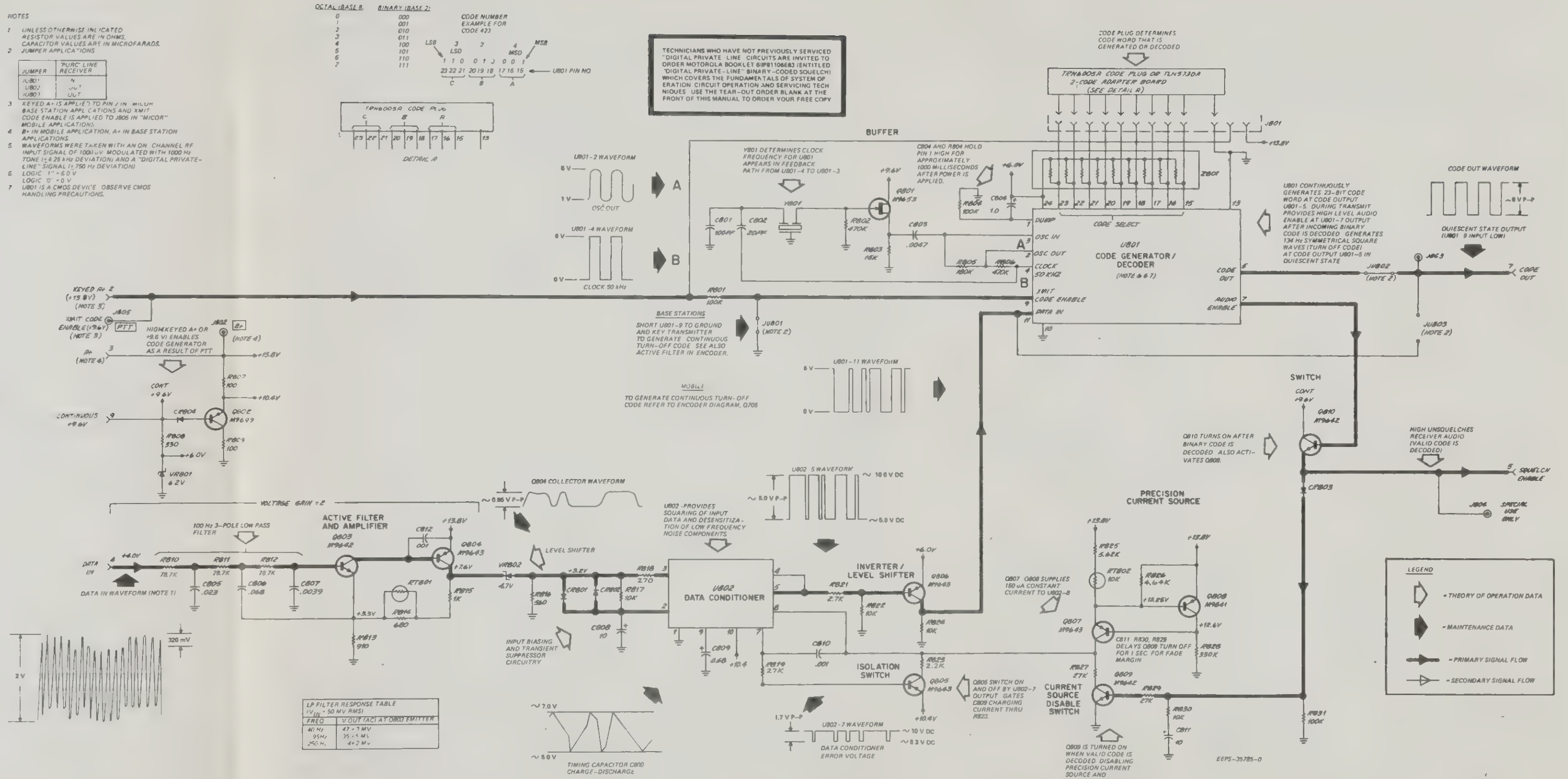
11. Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a simlar material (aluminum foil may be used). NEVER USE NON-CONDUCTIVE MATERIAL for packaging these modules.

parts list

TRN5768A *Digital Private-Line* Decoder Circuit Board PL-8338-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 5%; 50 V unless otherwise stated
C801	21-83798B01	100 pF, 200 V
C802	21-82610C22	20 pF, 200 V
C803	21-82428B56	.0047 ± 10%; 100 V
C804	23-82783B08	1.0 ± 20%; 35 V
C805	8-82905G39	.023
C806	8-83813H23	.068
C807	8-83813H19	.0039
C808	23-84762H03	10 ± 10%, 20 V
C809	23-82783B48	0.68; 35 V
C810	21-82187B20	1000 pF ± 10%, 100 V
C811	23-84762H03	10 ± 10%; 20 V
		diode (see note)
CR801, 802	48-84616A01	hot carrier
CR803	48-83654H01	silicon
CR804	48-82139G01	germanium
		transistor (see note)
Q801	48-869653	field-effect, type M9653
Q802	48-869649	PNP; type M9649
Q803	48-869642	NPN; type M9642
Q804 thru 807	48-869643	PNP; type M9643
Q808	48-869841	PNP; type M9841
Q809, 810	48-869642	NPN, type M9642
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R801	6-124C97	100k
R802	6-124D14	470k
R803	6-124C77	15k
R804	6-124C97	100k
R805	6-124D04	180k
R806	6-124D14	470k
R807	6-125C25	100; 1/2 W
R808	6-124C37	330
R809	6-125C25	100; 1/2 W
R810, 811, 812	6-84640C12	78.7k ± 1/2%
R813	6-124A48	810 ± 5
R814	6-124A45	680 ± 5%
R815	6-124A49	1k ± 5%
R816	6-124C43	560
R817	6-124C73	10k
R818	6-124C35	270
R819	6-124C83	27k
R821	6-124A59	2.7k
R822	6-124C73	10k
R823	6-124A57	2.2k ± 5%
R824	6-124C73	10k
R825	6-13755C67	5620 ± 1%
R826	6-10621C59	4640 ± 1%
R827	6-124C83	27k
R828	6-124B10	330k ± 5%
R829	6-124C83	27k
R830	6-124C73	10k
R831	6-124C97	100k
		thermistor
RT801	6-865641	300 ohms @ 25°C
RT802	6-82696B01	10k ohms @ 25°C
		integrated circuit: (see note)
U801	51-84267A82	M6782
U802	51-84320A55	M2055
		voltage regulator:
VR801	48-83696E07	Zener type, 6.2 V
VR802	48-82256C03	Zener type, 4.70 V
		crystal:
Y801	48-82003K01	resonator, 50.00000 KC
		resistor network
Z801	1-80772B36 or 51-82142K02	pull-up, 10-pin

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.


BUFFER
U801-2 WAVEFORM
U801-4 WAVEFORM
CLOCK 50 kHz
Y801
U801
CODE GENERATOR / DECODER
CODE SELECT
CODE OUT
XMIT CODE ENABLE
DATA IN
CODE OUT WAVEFORM
CODE PLUG DETERMINES CODE WORD THAT IS GENERATED OR DECODED
TRN6005A CODE PLUG OR TLN5330A 2-CODE ADAPTER BOARD
DETAIL A
BASE STATIONS
MOBILE
ACTIVE FILTER AND AMPLIFIER
LEVEL SHIFTER
U802
DATA CONDITIONER
INVERTER / LEVEL SHIFTER
ISOLATION SWITCH
CURRENT SOURCE DISABLE SWITCH
PRECISION CURRENT SOURCE
SWITCH
HIGH UNSQUELCHES RECEIVER AUDIO (VALID CODE IS DECODED)
SQUELCH ENABLE
DATA IN WAVEFORM (NOTE 5)
Q804 COLLECTOR WAVEFORM
U802-5 WAVEFORM
U802-7 WAVEFORM
TIMING CAPACITOR C810 CHARGE - DISCHARGE
LP FILTER RESPONSE TABLE
LEGEND
THEORY OF OPERATION DATA
MAINTENANCE DATA
PRIMARY SIGNAL FLOW
SECONDARY SIGNAL FLOW
CEPS-35785-O

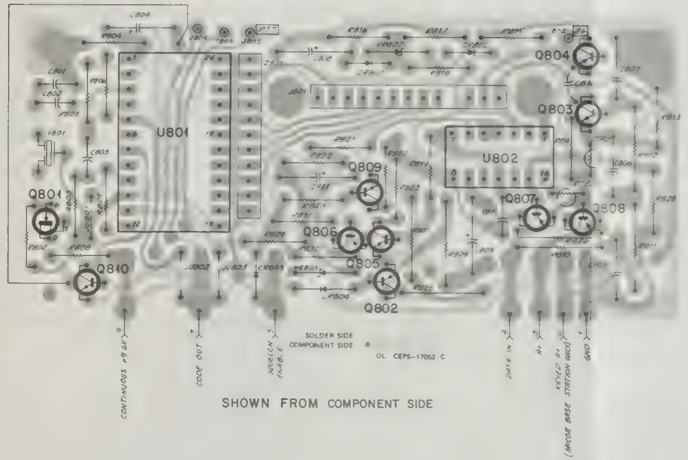
NOTES

1. UNLESS OTHERWISE INDICATED RESISTOR VALUES ARE IN OHMS. CAPACITOR VALUES ARE IN MICROFARADS.
2. JUMPER APPLICATIONS

JUMPER	"PURC" LINE RECEIVER
JU801	IN
JU802	OUT
JU803	OUT

3. KEYED A+ IS APPLIED TO PIN 2 IN "MICOR" BASE STATION APPLICATIONS AND XMIT CODE ENABLE IS APPLIED TO J805 IN "MICOR" MOBILE APPLICATIONS.
4. B+ IN MOBILE APPLICATION, A+ IN BASE STATION APPLICATIONS.
5. WAVEFORMS WERE TAKEN WITH AN ON-CHANNEL RF INPUT SIGNAL OF 1000 uV MODULATED WITH 1000 Hz TONE (±4.25 kHz DEVIATION) AND A "DIGITAL PRIVATE-LINE" SIGNAL (±750 Hz DEVIATION).
6. LOGIC "1" = 6.0 V
LOGIC "0" = 0 V
7. U801 IS A CMOS DEVICE. OBSERVE CMOS HANDLING PRECAUTIONS.

TECHNICIANS WHO HAVE NOT PREVIOUSLY SERVICED "DIGITAL PRIVATE-LINE" CIRCUITS ARE INVITED TO ORDER MOTOROLA BOOKLET 68P81106E83 (ENTITLED "DIGITAL PRIVATE-LINE" BINARY-CODED SQUELCH) WHICH COVERS THE FUNDAMENTALS OF SYSTEM OPERATION, CIRCUIT OPERATION AND SERVICING TECHNIQUES. USE THE TEAR-OUT ORDER BLANK AT THE FRONT OF THIS MANUAL TO ORDER YOUR FREE COPY.


U801
U802
Q801
Q802
Q803
Q804
Q805
Q806
Q807
Q808
Q809
Q810
SOLDER SIDE
COMPONENT SIDE
OL-CEPS-17062-C

SHOWN FROM COMPONENT SIDE

DIGITAL PRIVATE-LINE DECODER

MODEL TRN5768A

FUNCTION

1. Decodes a 23-bit binary code word to unsquelch the receiver.
2. In radios with simplex *Digital Private-Line* operation, generates a 23-bit binary code word when the transmitter is keyed.

Technical Characteristics

Code Determining Device	TRN6005A Code Plug
Code Format	23-Bit Word
Code Frequency Spectrum	11-67 Hz
Output	Switched 5.3 V dc

MOTOROLA INC.
Communications
Sector

LINK RECEIVER

MODEL TRE1333A
450-470 MHz

The TRE1333A consists of the following items:

- TKN8861A Receiver Meter Kit
- TLN4290B Audio Power Amplifier
- TLN4726B Receiver Interconnect Board
- TRE1242A 450-470 MHz Receiver
- TRN5716A Flat Audio and Squelch Board
- TRN5663A Hardware Kit

Refer to the following sections for more information:

TKN8861A Receiver Meter Kit	PEPS-35862
TLN4726B Receiver Interconnect Board Section	68P81026E72
TRE1242A 450-470 MHz Receiver Instruction Section	68P81063E81
TRN5716A Flat Audio and Squelch Board Instruction Section	68P81063E83
Cable Kits Instruction Section	68P81063E13
Hardware Kits Instruction Section	68P81063E84
TLN4290B Audio Power Amplifier Instruction Section	68P81014E97*

*Refer to appropriate station manual.

DIGITAL PRIVATE-LINE DECODER BOARD TROUBLESHOOTING CHART

NOTES:

1. To obtain a test code for the following procedure apply a carrier frequency signal to the receiver rf input from an rf signal generator modulated by the code output of a Motorola SLN6413A *Digital Private-Line* Test Set. Be sure the signal generator is able to accept very low frequency modulation (less than ± 5%).

2. Before you replace U801, use the following procedure to verify that U801 is malfunctioning:

   a. Connect U801-11 to the code input of a Motorola SLN6413A *Digital Private-Line* Test Set.
   b. Apply a carrier-frequency signal to the receiver rf input from a signal generator that is modulated by the code output of the test set.

   If proper decode is indicated, U801 must be replaced. If U801 must be replaced, refer to the CMOS handling precautions section of this manual.

Symptom	Probable Cause	Action
No decode, but received audio is good when PL is disabled.	1. Audio squelch is malfunctioning	Remove the decoder board. Apply +9.6 V at P201-3 on audio & squelch board. If audio is not enabled, troubleshoot audio & squelch circuits.
	2. No 50 kHz clock.	Check U801-4 for 50 kHz clock pulses. Rise time must be less than or equal to 750 nsec.
	3. Audio enable switch is malfunctioning.	If U801-7 is high, but circuit board pin 5 is low when receiving code, replace Q810.
	4. Dump pin U801-1 is always high.	Check U801-1. Should always be 0 V.
	5. Wrong or bad code plug.	Replace with a known good code plug. Check U801-15 through U801-23 for proper octal code.
	6. No data into U801.	Check U801-11 for 0-6 V pulses. If pulses are not present, check Q806 and U802 operation.
	7. Transmit code enable input is high.	Ground U801-9. If a received code is properly decoded, check for a malfunction in the delayed transmit enable circuit on the encoder board.
	8. U801 has an internal malfunction.	If, after checking causes 1 through 7, the cause of the problem has not been isolated, replace U801. **CAUTION** U801 is a CMOS device and may be damaged by improper handling. Refer to the CMOS handling precautions in this instruction manual.
Excessive decoder falsing when monitoring an inactive channel (noise falsing).	1. Precision current source is low or inoperative.	Measure the dc voltages in the precision current source circuits. $\text{Current to U802-8} = \frac{(V_{BE}\text{ of Q808})(R825+R826+RT802)}{R826\,(R825+RT802)}$
	2. Current source disable switch is always on.	Check for 8-10 V at Q809 collector. If Q809 collector is 0 V, replace Q809.
	3. Improper 140 Hz low pass filter response.	Check dc voltages in filter circuit. Check the filter frequency response. Measured at Q803 emitter, the filter response should be −1.0 to −4.0 dB at 95 Hz and −20 to −24 dB at 250 Hz with 50 mV rms signal at decoder input.
	4. U802 supply voltage is too high.	Check U802-10 for +10.4 V ±0.2 V dc. If voltage is high, troubleshoot the +10.4 V regulator on the decoder board.
Excessive squelch tails (approx. 500 msec noise burst) at ends of received transmissions.	1. Turn-off code not being transmitted by other radio unit.	Monitor circuit board pin 4 (DATA IN) for presence of turn-off code at ends of transmissions.
	2. U802 lock-in malfunction.	Ground Q809 collector. With a 300 mV p-p signal at circuit board pin 4 (DATA IN), the waveform at U802-4 should be locked in to the input signal up to at least 175 Hz. If proper lock-in does not occur, replace C809, then check lock-in again. If lock-in is still bad, replace U802.
	3. U801 turn-off code detector is malfunctioning.	Check U801 (Note 2).
Poor detector sensitivity in poor quieting conditions.	1. Improper 140 Hz low pass filter response.	Check dc voltages in filter circuit. Check the filter frequency response; measured at Q803 emitter, the filter response should be −1.0 to −4.0 dB at 95 Hz and −20 to −24 dB at 250 Hz with 50 mV rms signal at decoder input.
	2. Precision current source supplying too much current to U802-8.	Measure the dc voltages in the current source circuits. $\text{Current to U802-8} = \frac{(V_{BE}\text{ of Q808})(R825+R826+RT802)}{R826\,(R825+RT802)}$
	3. Current source disable switch inoperative.	While detecting a valid code, check Q809 collector for 0 V dc. If 8-10 V is present, replace Q809.
Occasional squelch tail about 1 second after the end of a transmission from another radio.	Current source disable switch is staying on too long.	Check Q809 collector. Q809 collector should go from 0 V dc to 8-10 V within 1.5 seconds after loss of audio squelch disable.

EPS-17705-D

MOTOROLA INC.
Communications
Sector

LINK RECEIVER

MODEL TRE1333A
450-470 MHz

The TRE1333A consists of the following items:

- TKN8861A Receiver Meter Kit
- TLN4290B Audio Power Amplifier
- TLN4726B Receiver Interconnect Board
- TRE1242A 450-470 MHz Receiver
- TRN5716A Flat Audio and Squelch Board
- TRN5663A Hardware Kit

Refer to the following sections for more information:

TKN8861A Receiver Meter Kit	PEPS-35862
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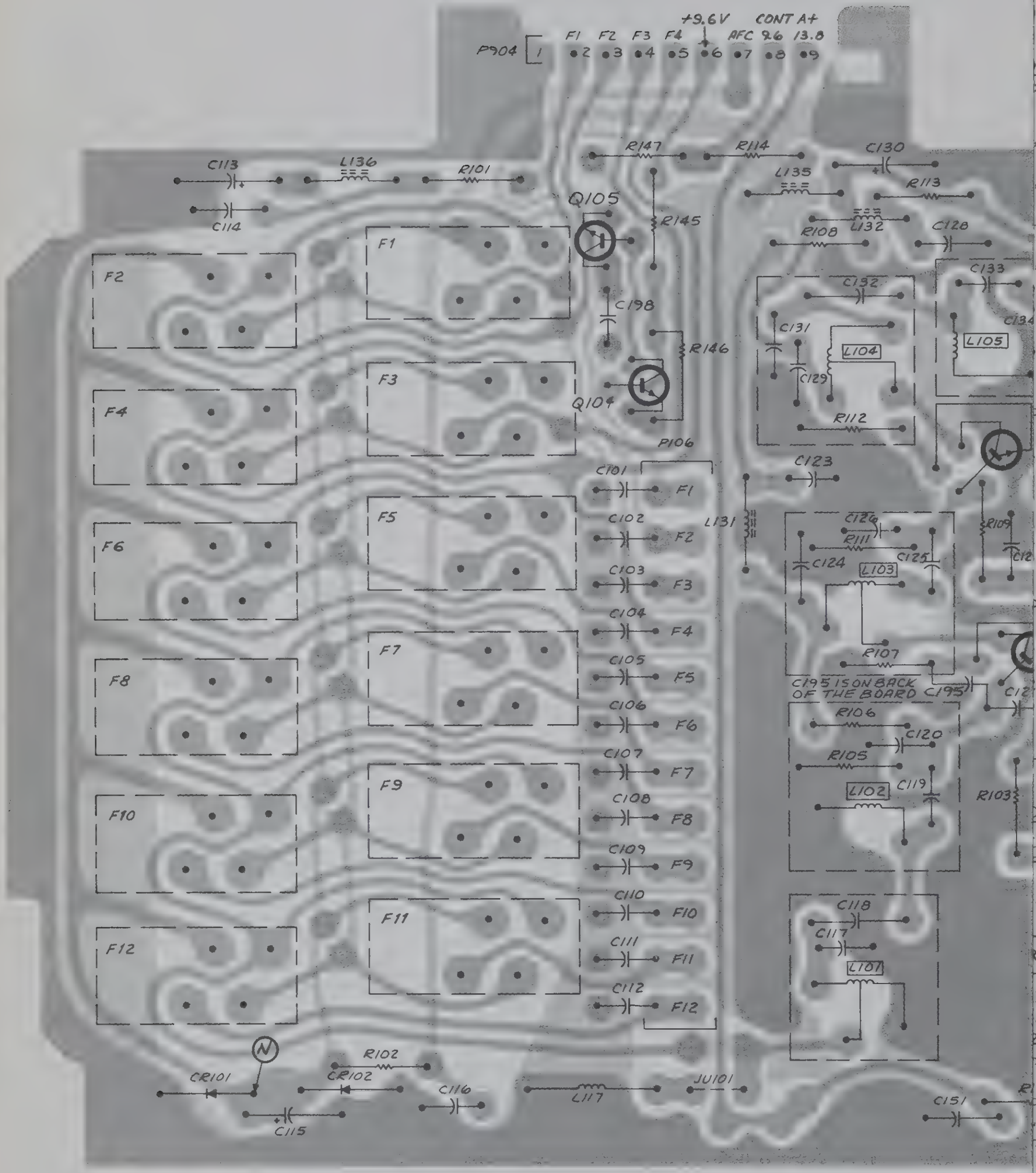
Cable Kits Instruction Section	68P81063E13
Hardware Kits Instruction Section	68P81063E84
TLN4290B Audio Power Amplifier Instruction Section	68P81014E97*

*Refer to appropriate station manual.

RECEIVER RF & IF


P904
1 F1 2 F2 3 F3 4 F4 5 +9.6V 6 AFC 7 CONT A+ 9.6 8 13.8 9
C113
L136
R101
C114
R147
R114
C130
Q105
R145
L135
R113
L132
R108
C128
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12
C198
R146
Q104
C131
C132
L104
C129
R112
C133
L105
C134
P106
C101 C102 C103 C104 C105 C106 C107 C108 C109 C110 C111 C112
L131
C123
C126
R111
C125
C124
L103
R109
R107
C195 IS ON BACK OF THE BOARD
C195
R106
C120
R105
L102
C119
R103
C118
C117
L101
R102
CR101
CR102
C116
L117
JU101
C115
C151
N

Motorola No. PEPS-24478-A
(Sheet 1 of 2)
8/15/82-UP

CRIPTION

MHz
) MHz
MHz
2 MHz
PL-1878-H

R, fixed:
500 V; NP0
%; 100 V
pF; 500 V; NP0
R, receptacle:
xial; miniature type
, RED); 6-5/8 turns,
, YEL); 6-1/8 turns,
ET-VIOLET);
; tapped
, GRN); 6-5/8 turns
BLU); 6-1/8 turns
RED); 6-5/8 turns,
YEL); 6-1/8 turns,
pped
, tapped
s, tapped
s
pped
, tapped
s, tapped
turns
turns
uH
fixed:
/4 W
/4 W
R, plug:
al; miniature type
R: (SEE NOTE)
; N-channel M9839

RENCED ITEMS

RD: includes
arts C142, C143,
2, Q104, R119
ing: used with
L108
oning: "star" type;
106, L107, L108
ing: used with
16
oning: "star" type;
111 thru 116

3-O
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425B01
SEE
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type
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RECEIVER RF & IF

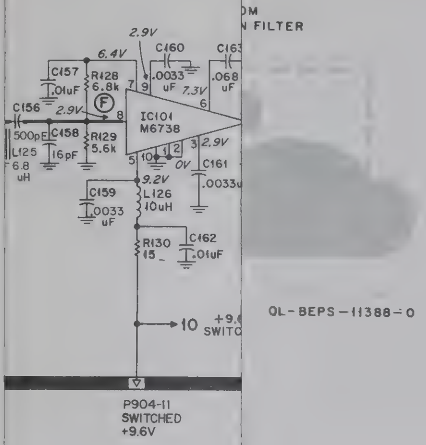
MODEL TRE1240A SERIES

RF PREAMPLIFIER (OPTIONAL)

MODEL TLE8190A SERIES

FUNCTION

Produce low level audio output from received FM signal.



OM
N FILTER
2.9V
6.4V
C160
C163
C157
.01uF
R128
6.8k
.0033
uF
7.3V
.068
uF
F
C156
2.9V
IC101
M6738
500pF
C158
16pF
R129
5.6k
L125
6.8
uH
2.9V
0V
C161
.0033u
9.2V
C159
.0033
uF
L126
10uH
R130
15
C162
.01uF
10
+9.
SWITC
P904-11
SWITCHED
+9.6V
OL-BEPS-11388-O

MATE
DIOD
OR U
SWIT

ER RF & IF NOTES

REQUENCY CALCULATION:

$_{c} = 24 f_{o} + 11.7$ MHz

$_{o} = \frac{f_{c} - 11.7 \text{ MHz}}{24}$

VHERE: f_c = CARRIER FREQUENCY f_o = CHANNE

DASHED LINES REPRESENT SHIELDING.
NDEX DOT ON Y106 CRYSTAL CAN INDICATE PH
REQUIRED.
JNLESS OTHERWISE STATED; CAPACITOR VALU
RESISTOR VALUES ARE IN OHMS.
RF VOLTAGES TAKEN WITH MOTOROLA SOLID–
METER WITH PLUG– RF PROBE.
JNLESS OTHERWISE STATED, VOLTAGE MEASUR
VOLTAGES MEASURED WITH AN 11 MEGOHM INP
METER IN RESPECT TO CHASSIS GROUND.
DC VOLTAGE IS FUNCTIONA OF SIGNAL LEVEL.
N 450–470 MHz MODELS, JU101 IS CUT IN RADIO
CHANNEL ELEMENTS. IN 470–512 MHz MODELS,
RADIOS HAVING UP TO FOUR CHANNEL ELEMEN
R144 MUST BE USED WITH RF DECK MODELS TLE
TLE8025A SUFFIX–1 OR LATER, AND WITH TLE8
VALUE DEPENDS ON FREQUENCY RANGE OF RA
NENT VALUE TABLE ON THIS PAGE.
FREQUENCY SELECTION IN MULTIPLE–FREQUE
PERFORMED BY DIODE MATRIX BOARD OR UNIV
BOARD.

RECEIVER R
COMPONENT VA

	TLE8921A
C117	27.0 pF
C118	0.62 pF
C119	39 pF
C125	12 pF
C126	33 pF
C131	3 pF
C133	6 pF
C134	8 pF
C136	51 pF
L117	NOT USED
L122	WHT
R115	39K
R116	2.2K
R118	2.7K
R119	680 OHM

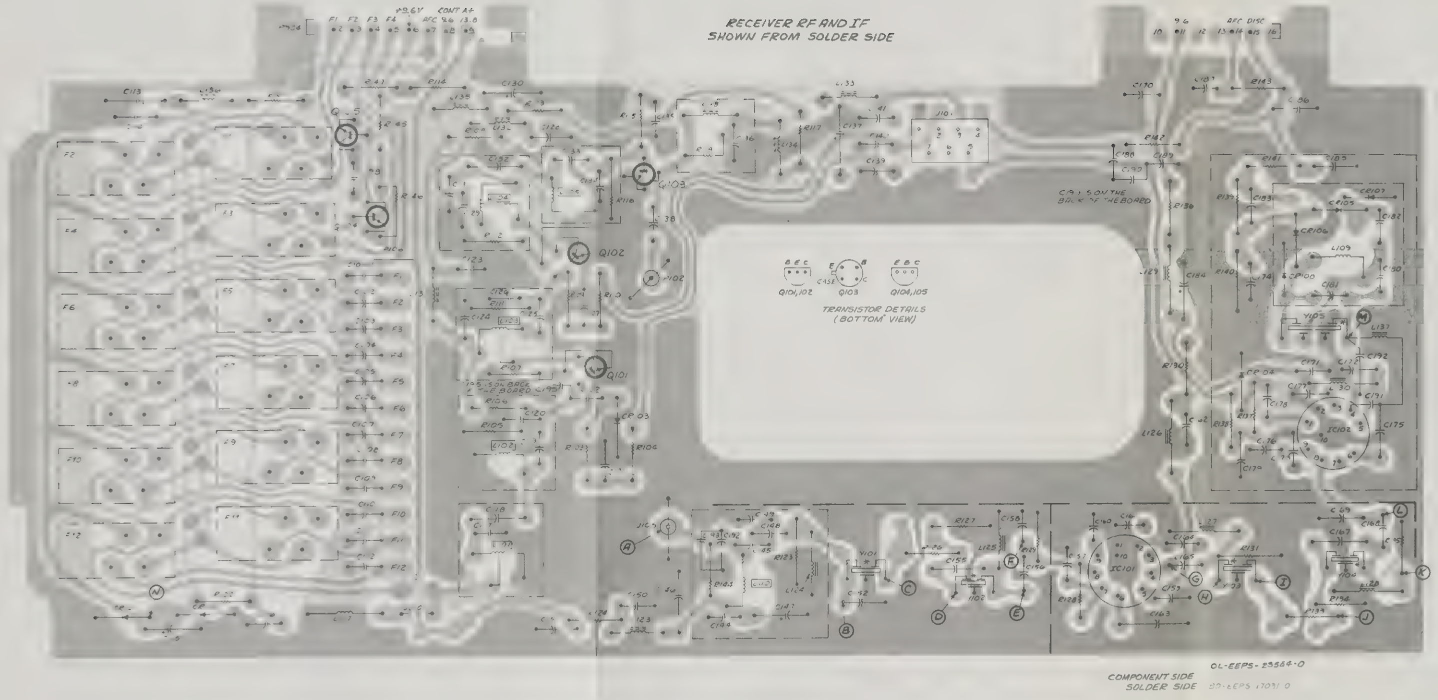
+9.
CONTINU

SWITCH
+9.6V

AR

Motorola No. ***PEPS-24478-A***
(Sheet 2 of 2)
8/15/82-UP

RECEIVER RF & IF



Motorola No. PEPS-24478-A
(Sheet 1 of 2)
8/15/82-UP

RF DECK

TLE8021A/B (406-420 MHz)
TLE8023A/B (450-470 MHz)
TLE8024A/B (470-494 MHz)
TLE8025A/B (494-512 MHz)

LEGEND:
L = 406-420 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz

PL-1878-H

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C142	21-840846	15 pF ±5%; 500 V; NP0
C143	21-83880C01	.001 uF ±10%; 100 V
C196	21-82355B26	10 pF ±0.25 pF; 500 V; NP0
		CONNECTOR, receptacle:
J102, 103, 104	9-84135B02	female; coaxial; miniature type
		COIL, RF:
L106L	24-84769E12	(coded RED, RED); 6-5/8 turns, tapped
L106M, H	24-84769E14	(coded YEL, YEL); 6-1/8 turns, tapped
L106HH	1-80752B34	(coded VIOLET-VIOLET); 5-7/8 turns; tapped
L107L	24-84769E15	(coded GRN, GRN); 6-5/8 turns
L107M, H, HH	24-84769E16	(coded BLU, BLU); 6-1/8 turns
L108L	24-84769E12	(coded RED, RED); 6-5/8 turns, tapped
L108M, H, HH	24-84734E01	(coded YEL, YEL); 6-1/8 turns, tapped
L111L	24-84731E09	4-1/2 turns
L111M	24-84731E01	4 turns, tapped
L111H	24-84731E04	3-3/4 turns, tapped
L111HH	24-84731E07	3-9/16 turns, tapped
L112L-115L	24-84731E10	4-1/2 turns
L112M-115M	24-84731E02	4 turns
L112H thru 115H	24-84731E05	3-3/4 turns
L112HH thru 115HH	24-84731E08	3-9/16 turns
L116L	24-84731E09	4-1/2 turns
L116M	24-84734E[illegible]	4 turns, tapped
L116H	24-84734E06	3-3/4 turns, tapped
L116HH	24-84734E07	3-9/16 turns, tapped
L122L	24-83884G06	YEL; 4-1/2 turns
L122M, H, HH	24-83884G03	BRN; 1-1/2 turns
L138	24-82723H04	choke; 0.29 uH
		RESISTOR, fixed:
R119L	6-10401C45	680 ±10%; 1/4 W
R119M, H, HH		560 ±10%; 1/4 W
		CONNECTOR, plug:
P105	28-84282D01	male; coaxial; miniature type
		TRANSISTOR: (SEE NOTE)
Q104L, M, H, HH	48-869839	field-effect; N-channel M9839
		NON-REFERENCED ITEMS
	1-80745B84	MIXER BOARD: includes reference parts C142, C143, C196, L122, Q104, R119
	3-138841	SCREW, tuning: used with L106, L107, L108
	2-84773E01	NUT, tensioning: "star" type; used with L106, L107, L108
	3-139002	SCREW, tuning: used with L111 thru 116
	2-84773E03	NUT, tensioning: "star" type; used with L111 thru 116

RECEIVER RF & IF BOARD

LEGEND
L = 406-420 MHz
M = 450-494 MHz
H = 494-512 MHz

TLE8921A (406-420 MHz)
TLE8922A (450-494 MHz)
TLE8923A (494-512 MHz)

PL-5988-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unless otherwise stated
C101 thru 112	21-82428B59	.01 uF +80-20%; 200 V
C113	23-84762H03	10 uF ±10%; 20 V
C114	21-82428B59	.01 uF +80-20%; 200 V
C115	23-84762H03	10 uF ±10%, 20 V
C116	21-82187B39	470 +10%
C117L	21-840895	27; N330
C117M	21-82133G44	18; N330
C117H	21-83406D01	13; N330
C118L	21-82450B46	0.62; coded BLU-RED-GRAY-GOLD
C118M, H	21-82450B29	0.51; coded GRN-BRN-GRAY-GOLD
C119L	21-83406D06	39; N220
C119M, H	21-84493B44	33; 250 V; N150
C120	21-82610C44	100; 100 V; N220
C121	21-82428B59	.01 uF +80-20%; 200 V
C122	21-857336	2 ±0.25 pF; NP0
C123	21-82187B08	220 ±10%
C124	21-82187B11	.0015 uF ±10%; 100 V
C125L	21-82133G73	12; N150
C125M, H	21-838912	8 +0.25 pF; N150
C126L	21-84493B44	33; N150
C126M, H	21-82610C14	30; 200 V; N150
C127	21-82428B59	.01 uF +80-20%; 200 V
C128	21-831125	100 ±10%; 300 V; N750
C129	21-82187B08	220 ±10%
C130	23-84762H04	2.2 uF ±20%; 25 V
C131L	21-83406D51	3 ±0.25 pF; NP0
C131M	21-857336	2.0 ±.25 pF; NP0
C131H	21-868487	1.5 ±0.25 pF; NP0
C132	21-82450B35	0.2 ±10%; coded RED-BLK-GRAY-SILVER
C133L	21-82133G18	6 ±0.25 pF; N470
C133M, H	21-849320	4 +0.25 pF; N470
C134L	21-84493B43	8 ±0.25 pF; N470
C134M, H	21-82204B33	5 ±0.25 pF; N470
C135	21-82428B59	.01 uF +80-20%; 200 V
C136L	21-82610C07	51; 200 V; N150
C136M, H	21-847056	10; 250 V; N150
C137	23-84762H04	2.2 uF ±20%; 25 V
C138	21-82355B30	2.7 ±0.1 pF; NP0
C139, 140	21-82428B59	.01 uF +80-20%; 200 V
C141	21-82187B17	820 ±10%
C144	21-82610C03	47; 200 V; N220
C145	21-82133G01	10; NP0
C146	8-82905G04	.068 uF ±10%; 50 V
C147	23-84762H04	2.2 uF ±20%; 25 V
C148, 149	21-82133G01	10; NP0
C150, 151	21-82428B59	.01 uF +80-20%; 200 V
C152	21-82133G33	6.8 ±0.5 pF; NP0
C155	21-82450B04	0.3; coded ORG-BLK-GRAY-GOLD
C156	21-82537B23	500; 100 V; NP0
C157	21-82428B59	.01 uF +80-20%; 200 V
C158	21-848525	16; NP0
C159, 160, 161	21-82428B57	.0033 uF ±10%; 200 V
C162	21-82428B59	.01 uF +80-20%; 200 V
C163	8-83813H05	.068 uF ±10%; 100 V
C164	21-82610C84	39; 450 V; NP0
C165	21-82610C84	39; NP0
C167	21-82450B04	0.3; coded ORG-BLK-GRAY-GOLD
C168	21-84493B27	51; NP0
C169	21-82355B09	33; 100 V; NP0
C170	21-82428B57	.0033 uF ±10%; 200 V
C171, 172	21-82428B59	.01 uF +80-20%; 200 V
C173	21-82428B57	.0033 uF ±10%; 200 V
C174	23-84762H04	2.2 uF ±20%; 25 V
C175	8-83813H06	0.1 uF ±10%; 100 V
C176, 177	21-82428B57	.0033 uF ±10%; 200 V
C178	21-82187B08	220 ±10%
C179	21-82428B57	.0033 uF ±10%; 200 V
C180 thru 184	21-83798B01	100; 200 V; NP0
C185, 186, 187	21-82187B39	470 ±10%
C188	21-82428B59	.01 uF +80-20%; 200 V
C189	21-82428B57	.0033 uF ±10%; 200 V
C190	21-84493B24	40; N150
C191	21-82610C07	51; N150
C192	21-861443	.01 uF +100-20%; 75 V
C193, 194	21-840848	6 ±.5; NP0
C195	21-82355B26	10 ±0.25; NP0
C197	21-82355B26	10 ±0.25; NP0
C198	21-82428B59	0.01 uF +80-20%; 200 V
		SEMICONDUCTOR DEVICE diode: (SEE NOTE I)
CR101, 102	48-82392B13	silicon
CR103, 104	48-82139G01	germanium
CR105 thru 108	48-84616A01	silicon; hot carrier type
		INTEGRATED CIRCUIT:
IC101	51-84561L68	type M6168
IC102	51-84561L69	type M6169
		CONNECTOR, receptacle:
J105	9-84231B02	female; coaxial; miniature type
		COIL, RF:
L101	24-84972A15	BRN; 8-1/2 turns, tapped at 2-1/8 turns; include tuning core
L102	24-84972A16	RED; 8-1/2 turns; includes tuning core
L103	24-84972A17	ORG; 6-1/2 turns, tapped at 1-1/8 turns; includes tuning core
L104	24-83857G07	YEL; 3-1/2 turns, tapped at 1-5/8 turns; includes tuning core
L105	24-83856G05	GRN; 3-1/2 turns; includes tuning core
L109	24-83879G04	YEL; 20 turns; includes tuning core
L110	24-84258B06	BLU; 16-2/3 turns; includes tuning core
L117L		NOT USED
L117M	24-82542E01	.31 uH; choke
L117H	24-82542E11	.245 uH; choke
L118	24-82723H03	3 turns
L120, 121		NOT USED
L123	24-82723H07	choke; 10 uH; coded VIO
L124	24-82549D25	choke; 10 uH; shielded; coded (SILVER) BRN-BLK-BLK-GOLD
L125	24-84250D02	choke; 6.8 uH; shielded; coded WHT-BLU-GOLD-GRAY-GOLD
L126	24-82723H07	choke; 10 uH; coded VIO
L127, 128	24-84250D02	choke; 6.8 uH; shielded; coded WHT-BLU-GOLD-GRAY-GOLD
L129, 130	24-82723H07	choke; 10 uH; coded VIO
L131 thru 136	24-83961B01	3 turns over ferrite bead; coded BRN
L137	24-84250D03	choke; 2.2 uH (shld.) coded WHT-RED-GOLD-RED-GOLD
		CONNECTOR, plug
P102	28-84227B01	male; coaxial; miniature type
		TRANSISTOR: (SEE NOTE I)
Q101, 102	48-869658	NPN; type M9658
Q103	48-869756	NPN; type M9756
Q104, 105	48-869642	NPN; type M9642
		CONNECTOR, plug
P106		(for reference only)
		RESISTOR, fixed: ±10%; 1/4 W; unless otherwise stated
R101	6-129755	10
R102	6-127807	33k
R103	6-129230	12k
R104	6-129231	3.3k
R105	6-129269	1.8k
R106	6-127806	27k
R107	6-10401A13	33 ±5%
R108	6-129862	150
R109	6-128685	22k
R110	6-129231	3.3k
R111	6-129269	1.8k
R112	6-124A09	22 ±5%
R113	6-129862	150
R114	6-129755	10
R115L	6-10401C87	39k
R115M, H	6-127807	33k
R116L	6-10401C57	[illegible]
R116M, H	6-127803	[illegible]
R117	6-129224	[illegible]
R118L	6-10401C59	[illegible]
R118M, H	6-127803	[illegible]
R120, 121		NOT USED
R123	6-129667	22k ±5%
R124	6-129233	47
R126	6-124A08	270 ±5%
R127	6-124A93	68k ±5%
R128	6-129237	6.8k ±5%
R129	6-129982	5.6k ±5%
R130	6-131377	15
R131	6-129236	15k ±5%
R133	6-124A08	270 ±5%
R134	6-124A99	270 ±5%
R135	6-129668	10k ±5%
R136	6-129755	10
R137	6-124C86	36k
R138	6-127803	[illegible]
R139	6-124A76	13k ±5%
R140	6-124A76	13k ±5%
R141	6-127802	[illegible]
R142	6-129226	100k
R143	[illegible]	[illegible]
R144	6-10401C81	22k
R145	6-124C89	47k
R146	6-124C69	6.8k
R147	6-124C89	47k
		CRYSTAL UNIT, quartz 11.7 MHz
Y101	48-84755E08	i-f filter
Y102*	48-84755E07	i-f filter
Y103*, 104	48-84755E07	i-f filter
Y104	48-84754E01	discriminator
		*When replacing Y102, Y103 or Y104, order Part No. 48-84755E07 only.

NOTE:
For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

PREAMPLIFIER

TLE8191A Preamplifier (406-450 MHz)
TLE8192A Preamplifier (450-512 MHz)

PL-2693-O

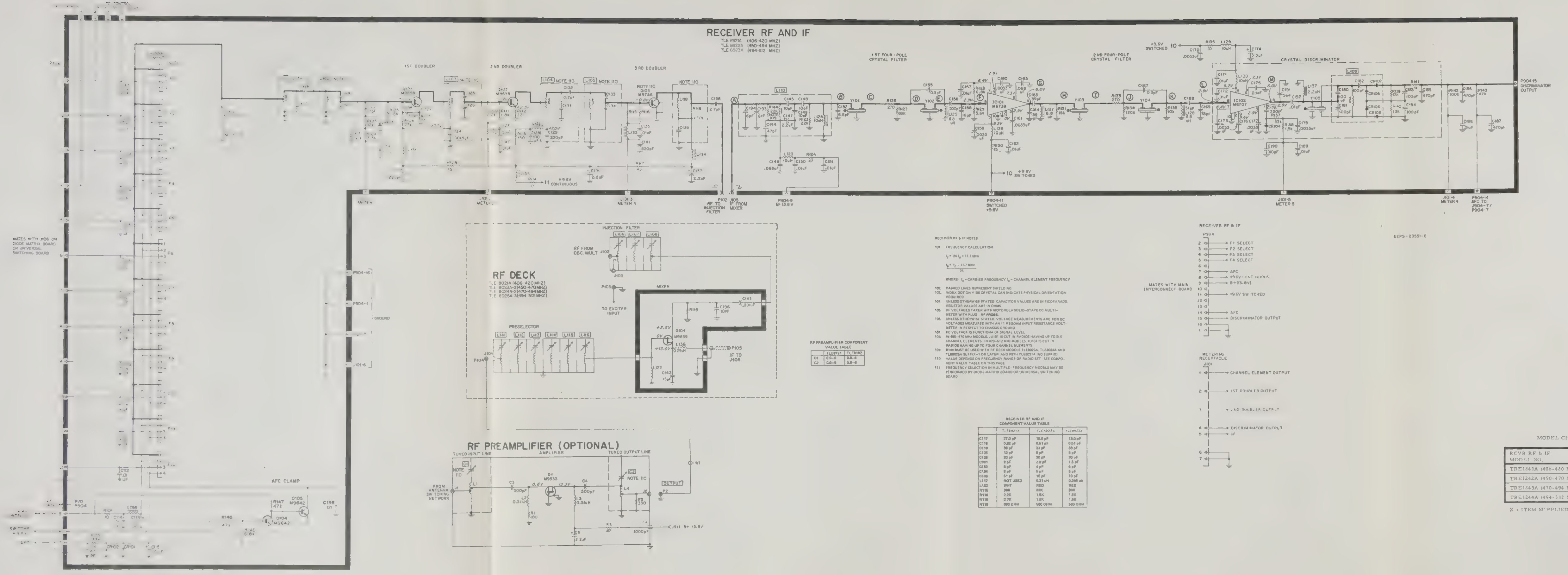
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, variable: (includes standard tuning "piston"):
C1, 2	20-83693H03 or 20-83693H01	0.9 - 9.0 pF (406-450 MHz) 0.8 - 6.0 pF (450-512 MHz) (NOTE: Also order 76-84425B01 PISTON, tuning;)(special; SEE NOTE II)
		CAPACITOR, fixed:
C3, 4	21-861441	500 pF ±10%; 75 V; N4700
C5	21-861219	.001 uF +100-0%; 500 V; coded RED
C6	23-84762H04	2.2 uF ±20%; 25 V
		CONNECTOR, receptacle:
J1, 2	9-84135B01	female; coaxial; miniature type
		COIL, RF:
L1	47-84330B01	(straight rod; 1.75" long)
L2, 3	24-800484	choke; 0.31 uH
L4	47-84330B03	(straight rod; 2.19" long)
		CONNECTOR, plug:
P2, 104	28-84282D01	male; coaxial; miniature type
		TRANSISTOR: (SEE NOTE I)
Q1	48-869533	field-effect; N-Channel; type M9533; does not include 42-83660C01 CLIP, transistor retaining
		RESISTOR, fixed:
R1	6-10401C25	100 ±10%; 1/4 W
R2	6-185B73	330 ±10%; 1/8 W
R3	6-10401C17	47 ±10%; 1/4 W
		LINE, RF transmission:
W1	1-80739B37	includes P2, P104 and 30-83794C01 CABLE, RF: coaxial; 6-1/2" length required

RECEIVER RF & IF

MODEL TRE1240A SERIES

RF PREAMPLIFIER (OPTIONAL)

MODEL TLE8190A SERIES


RECEIVER RF AND IF
TLE 8921A (406-420 MHZ)
TLE 8922A (450-494 MHZ)
TLE 8923A (494-512 MHZ)
1ST DOUBLER
2 ND DOUBLER
3 RD DOUBLER
NOTE 110
1ST FOUR - POLE CRYSTAL FILTER
2 ND FOUR - POLE CRYSTAL FILTER
CRYSTAL DISCRIMINATOR
+9.6V SWITCHED
+9.6V CONTINUOUS
P904-15 DISCRIMINATOR OUTPUT
J101-2 METER 2
J101-3 METER 3
P102 RF TO INJECTION FILTER
J105 IF FROM MIXER
P904-9 B+13.8V
P904-11 SWITCHED +9.6V
J101-5 METER 5
J101-4 METER 4
P904-14 AFC TO J904-7/ P904-7
MATES WITH P00 ON DIODE MATRIX BOARD OR UNIVERSAL SWITCHING BOARD
GROUND
AFC CLAMP
RF DECK
TLE 8021A (406 420 MHZ)
TLE 8023A-2(450-470 MHZ)
TLE 8024A-2(470-494 MHZ)
TLE 8025A 3(494 512 MHZ)
INJECTION FILTER
RF FROM OSC. MULT
J102
J103
P103
TO EXCITER INPUT
MIXER
PRESELECTOR
J104
P104
Q104 M9839
P105 IF TO J105
RF PREAMPLIFIER (OPTIONAL)
TUNED INPUT LINE
AMPLIFIER
TUNED OUTPUT LINE
FROM ANTENNA SWITCHING NETWORK
OUTPUT
RECEIVER RF & IF
P904
F1 SELECT
F2 SELECT
F3 SELECT
F4 SELECT
AFC
+9.6V CONTINUOUS
B+(13.8V)
+9.6V SWITCHED
AFC
DISCRIMINATOR OUTPUT
MATES WITH MAIN INTERCONNECT BOARD
METERING RECEPTACLE
J101
CHANNEL ELEMENT OUTPUT
1ST DOUBLER OUTPUT
2ND DOUBLER OUTPUT
DISCRIMINATOR OUTPUT
IF
EEPS-23051-9

RF PREAMPLIFIER COMPONENT VALUE TABLE

	TLE8191	TLE8192
C1	0.9–9	0.8–6
C2	0.9–9	0.8–6

RECEIVER RF & IF NOTES

101 FREQUENCY CALCULATION:

$f_c = 24 f_0 + 11.7$ MHz

$f_0 = \frac{f_c - 11.7 \text{ MHz}}{24}$

WHERE: f_c = CARRIER FREQUENCY f_0 = CHANNEL ELEMENT FREQUENCY

102. DASHED LINES REPRESENT SHIELDING

103. INDEX DOT ON Y108 CRYSTAL CAN INDICATE PHYSICAL ORIENTATION REQUIRED

104. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS.

105. RF VOLTAGES TAKEN WITH MOTOROLA SOLID-STATE DC MULTIMETER WITH PLUG- RF PROBE.

106. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND

107 DC VOLTAGE IS FUNCTIONA OF SIGNAL LEVEL

108. IN 450–470 MHz MODELS, JU101 IS CUT IN RADIOS HAVING UP TO SIX CHANNEL ELEMENTS. IN 470–512 MHz MODELS, JU101 IS CUT IN RADIOS HAVING UP TO FOUR CHANNEL ELEMENTS

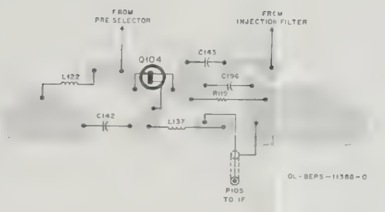
109 R144 MUST BE USED WITH RF DECK MODELS TLE8023A, TLE8024A AND TLE8025A SUFFIX–1 OR LATER AND WITH TLE8021A (NO SUFFIX).

110 VALUE DEPENDS ON FREQUENCY RANGE OF RADIO SET. SEE COMPONENT VALUE TABLE ON THIS PAGE.

111 FREQUENCY SELECTION IN MULTIPLE-FREQUENCY MODELS MAY BE PERFORMED BY DIODE MATRIX BOARD OR UNIVERSAL SWITCHING BOARD

RECEIVER RF AND IF COMPONENT VALUE TABLE

	TLE8921A	TLE8922A	TLE8923A
C117	27.0 pF	16.0 pF	13.0 pF
C118	0.82 pF	0.51 pF	0.51 pF
C119	36 pF	33 pF	33 pF
C125	12 pF	8 pF	8 pF
C126	33 pF	30 pF	30 pF
C131	3 pF	2.0 pF	1.5 pF
C133	6 pF	4 pF	4 pF
C134	8 pF	5 pF	5 pF
C136	51 pF	10 pF	10 pF
L117	NOT USED	0.31 uH	0.245 uH
L122	WHT	RED	RED
R115	39K	33K	33K
R116	2.2K	1.5K	1.5K
R118	2.7K	1.5K	1.5K
R119	680 OHM	560 OHM	560 OHM


FROM PRE SELECTOR
FROM INJECTION FILTER
Q104
C143
C196
R119
L122
C142
L137
P105 TO IF
OL-BEPS-11388-0

FUNCTION

Produce low level audio output from received FM signal.

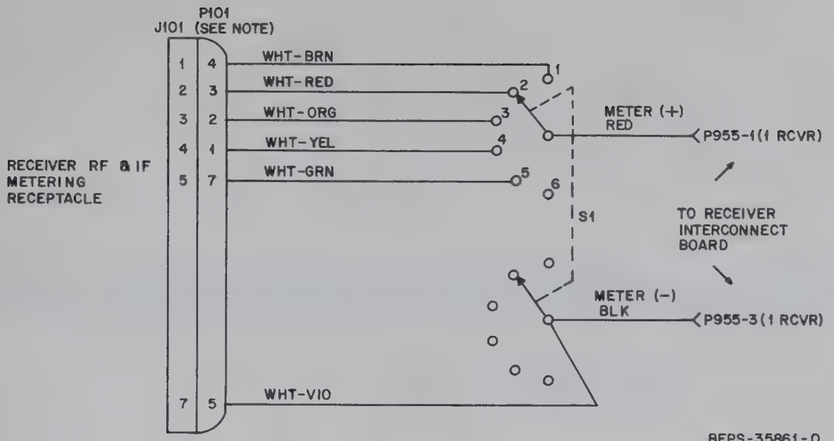
MODEL CHART

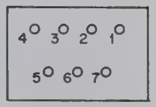
RCVR RF & IF MODEL NO.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TRE1241A (406-420 MHz							
TRE1242A (450-470 MHz)		X				X	
TRE1243A (470-494 MHz)			X			X	
TRE1244A (494-512 MHz							

X = ITEM SUPPLIED

EPS 24623-C

Motorola No. PEPS-24478-A
(Sheet 2 of 2)
8 15 82-UP


P101
J101 (SEE NOTE)
RECEIVER RF & IF METERING RECEPTACLE
1 4
2 3
3 2
4 1
5 7
7 5
WHT-BRN
WHT-RED
WHT-ORG
WHT-YEL
WHT-GRN
WHT-VIO
1
2
3
4
5
6
S1
METER (+) RED
P955-1 (1 RCVR)
TO RECEIVER INTERCONNECT BOARD
METER (−) BLK
P955-3 (1 RCVR)



P401 DETAIL
(SHOWN FROM
PIN SIDE)

BEPS-35861-O

SI SWITCH POSITION	FUNCTION METERED
1	CHANNEL ELEMENT OUTPUT
2	FIRST DOUBLER
3	SECOND DOUBLER
4	DISCRIMINATOR
5	LIMITER

NOTE:
RECEIVER METER PLUG IS INSERTED FROM REAR OF STATION.

parts list

TKN8861A Receiver Meter Kit PL-8336-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
P101	28-84208B01	male; 7-contact
		switch, rotary:
S1	40-84618G01	2-pole; 6-position; non-shorting; does not include:
	36-82630H01	KNOB, control
		mechanical parts
	2-7018	NUT, 3/8-32 × 1/2 × 3/32"
	4-7698	LOCKWASHER, 3/8" internal
	39-10184A24	RECEPTACLE, contact; 2 used
	42-10217A02	STRAP, tie: .091 × 3.62" (WHT); 8 used
	42-84834G01	CLIP, cable

TKN8861A Receiver Meter Kit
Schematic Diagram and Parts List
*Motorola No. **PEPS-35862-O***
2/15/83- UP

MOTOROLA INC.
Communications
Sector

RECEIVER
MODEL TRE1242A
450-470 MHz

ALIGNMENT

1. FREQUENCY CALCULATIONS

$$f_o = \frac{f_c - 11.7\text{ MHz}}{24}$$

or

$$f_o = \frac{f_c - 11.8\text{ MHz}}{24}$$

Where: f_c = carrier frequency
f_o = channel element frequency
11.7 MHz = mixer output frequency (i-f)
11.8 MHz = mixer output frequency (i-f shifted)
24 = channel element harmonic

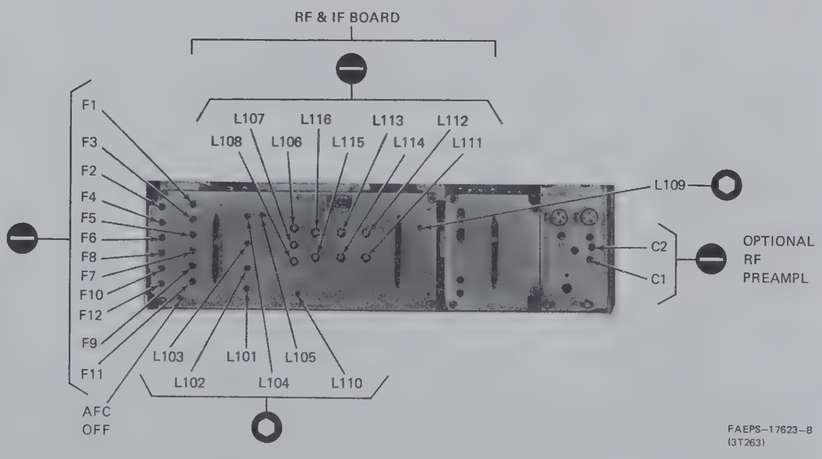
The receiver i-f is factory shifted from 11.7 MHz to 11.8 MHz when the difference between received carrier (channel spacing) frequencies is:

11.7 MHz ±25 kHz
5.85 MHz ±25 kHz
3.90 MHz ±25 kHz
2.925 MHz ±25 kHz

2. TUNE-UP FREQUENCY SELECTION FOR MULTI-FREQUENCY STATIONS

2.1 Maximum frequency separation up to .5 MHz - Set the frequency selector switch to the frequency closest to the center of the range covered. For two-frequency radios select the higher frequency.

2.2 Maximum frequency separation between .5 MHz and 1.0 MHz - Remove one channel element and insert a tune-up element whose frequency is midway between the two most widely separated frequencies. Set the frequency selector switch to select this element.


RF & IF BOARD
F1
F3
F2
F4
F5
F6
F8
F7
F10
F12
F9
F11
AFC OFF
L107
L116
L113
L112
L108
L106
L115
L114
L111
L109
C2
C1
OPTIONAL RF PREAMPL
L103
L101
L105
L102
L104
L110
FAEPS–17623–8
(3T263)

Receiver Adjustment Locations

3. RECEIVER ALIGNMENT (RF & I-F BOARD)

NOTE:
This procedure includes optional rf preamplifier alignment details. If an optional rf preamplifier is not used, simply disregard preamplifier identified steps in the procedure.

Step	Adjustment	Meter Position	Stage and Procedure
1	L101, L102, L103, L104, L105	—	Multiplier Coils — Adjust the cores of L101 through L105 to the end of the coil form away from the circuit board.
2	L106, L107, L108	—	Injection Filter — Adjust the tuning screws for L106 through L108 until the top of each tuning screw extends approximately one-eighth inch below the receiver shield.
3	L101, L102	1	Channel Element Output — Alternately tune L101 and L102 CCW two turns at a time until a peak indication on meter 1 is obtained.
4	L103, L104	2	First Doubler — Tune L103 CCW for a peak reading on meter 2. Tune L104 CCW for a dip on meter 2.
5	L105, L104	3	Second Doubler — Tune L105 CCW for a peak on meter 3. Tune L104 for a peak on meter 3. Repeak both coils until no further improvement can be obtained.
6	L101, L103	3	Detune L101 until meter 3 drops to 10 uA. Tune L103 for peak reading on meter 3, keeping this peak below 12 uA by further detuning of L101 if necessary.
7	L101, L102	1	Alternately tune L101 and L102 for peak reading on meter 1 until no further improvement can be obtained.
8	L106, L107, L108	3	Injection Filter — Tune L106 for a dip on meter 3. Tune L107 for a peak reading on meter 3. Tune L108 for a dip on meter 3. Do not repeat.
9	L109	4, 5	Discriminator — Insert 11.7 MHz injection probe of the test set into L110 hole on receiver shield. Be careful not to contact the circuit board. Set METER REV switch to position A or B for this step and be sure that the test set is equipped with an 11.7 MHz crystal in the corresponding A or B socket. Insert the injection probe far enough to obtain a saturated reading on meter 5. It should be possible to obtain readings on either side of zero (center) on meter 4 by tuning L109. Tune L109 for an EXACT zero reading on meter 4. This adjustment is critical.
10	L110, L111, L112, L113, L114, L115, L116	4, 5	RF Preselector and Mixer — Unsquelch the receiver by tuning the SQUELCH control fully counterclockwise. Disable the PL decoder by switching the PL monitor switch on the STATION CONTROL MODULE to the DISABLE position. Connect an rf signal generator to the receiver input connector and set the rf output of the generator to maximum. **NOTE** If the receiver frequency has been changed by more than 1 MHz, preset tuning screws L111 through L116 so that the screw end is in the space between the board and its shield, and approximately one-eighth inch from the shield. If the receiver is equipped with the optional preamplifier, disconnect and bypass the preamplifier. Set the generator to the carrier frequency by observing meters 4 and 5. **NOTE** If no indication is seen, unscrew the shell of the antenna cable connector, and pull the plug partially out of the jack so that the cable shield no longer makes contact with the station chassis. Set the generator to the carrier frequency as indicated by meter positions 4 and 5, then reconnect the cable shield to the radio. Adjust L111 through L116 clockwise one turn at a time, watching meter 5 for an increase in indication above noise level. Tune L111 through L116 for peak reading on meter 5, reducing generator output level as necessary to keep meter 5 out of saturation. Tune L110 for peak on meter 5. Repeat the adjust of L111 through L116. Turn L111 through L116 in or out as necessary until all screws are level. Repeat the adjustment of L111 through L116.
11	L106, L107, L108	11 (rcvr audio)	Tune L106, L107 and L108 for best noise quieting (minimum meter indication). Maximum meter 11 sensitivity may be obtained by placing the multipler switch on the test set in the .2 V AC position.
12	L111, L112, L113, L114, L115, L116	11 (rcvr audio)	Tune L111 through L116 for best noise quieting. Repeat until no further improvement in quieting level can be obtained.

Step	Adjustment	Meter Position	Stage and Procedure
13	C1, C2, L111	5, 11	Preamplifier — If the receiver is equipped with the optional preamplifier, reconnect the preamplifier. Tune C1 and C2 for maximum meter 5 reading. Then tune C1, C2, and L111 for best noise quieting on meter 11.
14			Perform 20 dB quieting sensitivity measurement as check of alignment. Refer to the following Receiver Maintenance information which describes how to check 20 dB quieting sensitivity. The 20 dB quieting level should be less than .5 uV (.25 uV with preamplifier).

MAINTENANCE

1. RECEIVER RF AND I-F BOARD

CAUTION

Do not remove the channel element by exerting force through the hole provided for access to the channel warp capacitor. Excessive pressure will damage the capacitor. A small access hole is provided adjacent to the one for channel warp. Use a tuning tool (Motorola Part No. 66D84387C01) to push out element.

1.1 INTRODUCTION

This section provides maintenance procedures for the receiver rf and i-f board. These procedures consists of tests which include metering measurements and testing and troubleshooting procedures that include integrated circuit checks.

NOTE

The receiver rf and i-f board must be installed in a receiver for testing to provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stages of the receiver. The board may be installed in the station or a *Micor* mobile radio set for testing.

1.2 PERFORMANCE TESTS

Use the following tests to determine if the receiver rf and i-f board is operating properly. If either of the tests produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart for a procedure to isolate the defective stage.

1.2.1 No-Signal Meter Reading Check

1.2.1.1 General

1.2.1.1.1 A failure in almost any part of the rf and i-f board results in an improper meter reading in one or more of the test positions. Improper alignment also causes improper meter readings.

1.2.1.1.2 Compare the current readings observed in positions 1 through 5 with those in the following table. A low reading on meter position 1 indicates a defective channel element. A low reading on meter positions 2 or 3 indicates a defective multiplier circuit. Improper meter 4 or 5 readings indicate a malfunction elsewhere in the receiver; check rf and i-f voltages per the schematic diagram to isolate the malfunction.

Minimum Receiver RF & I-F Meter Readings Table (No Input Signal Applied)

Selector Switch Position	Reading (Microamps)	Circuit Metered
1	15	Channel element output
2	15	First Doubler output
3	15	Second Doubler output
4+, 4−	0 ±2	Discriminator output
5	10	Second i-f amplifier and limiter

1.2.1.2 Input Voltages

1.2.1.2.1 If there are no test set indications at one or more of the metered points, check the dc input voltages to the receiver rf and i-f circuit board.

P904-9	A+ continuous (+13.8 V dc with reference to chassis)
P904-11	9.6 V dc continuous (with reference to chassis) (±0.5 V)
P904-8	9.6 V dc continuous (with reference to chassis) (±0.5 V)

1.2.1.2.2 If test set indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

1.2.1.3 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the station as follows:

- Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.
- Connect the adapter cable 7-pin red "control" plug to the control receptacle on the unified chassis (J3).
- Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:

- Set the function switch to the RCVR position.
- Set the meter reversing switch to the OFF position.
- Set the adapter cable SENS switch to the 100 mV position. If the adapter cable has no SENS switch, the unit operates at 100 mV all of the time.
- Set the adapter cable reference switch to position A or position B.

Step 6. Refer to the meter reading table in paragraph 1.2.1. Set the test set selector switch to the positions called for in the table and observe the test set meter. Notice that the metering readings given in the table are minimums.

1.2.1.4 Using Built-In Station Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Connect the station metering kit "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Refer to the meter reading table in paragraph 1.2.1. Set the meter selector switch to the positions called for in the table and observe the meter. Notice that the meter readings given in the table are minimums.

1.2.2 20 dB Quieting Sensitivity Test

This performance test may be used after repair and alignment to assure that the receiver meets all specifications before it is returned to service. The receiver shield must be in place while performing this test.

1.2.2.1 Using the Portable Test Set

Step 1. Set up the station and portable test set or meter panel as described in steps 1 through 5 of paragraph 1.2.1.3.

Step 2. Set the portable test set MULT switch to the 2 V ac position.

Step 3. Set the portable test set selector switch to position 11 (audio).

Step 4. Set the test set SPKR switch to the LOAD position and disconnect the station speaker if you want to silence the station speaker during the test.

Step 5. On *Private-Line* stations, disable PL by setting the PL slide switch on the STATION CONTROL MODULE in the DISABLE position.

Step 6. Set the receiver SQUELCH control fully counterclockwise (unsquelched).

Step 7. Adjust the receiver VOLUME control so the test set meter reads 2 volts ac.

Step 8. Connect an rf signal generator to the receiver input connector.

Step 9. Set the signal generator controls as follows:

- Set up the signal generator to produce a CW or unmodulated signal.
- Set the generator output level to maximum
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until test set meter position 4 reads exactly zero.

Step 10. With the portable test set selector switch in meter position 11 (audio), slowly decrease the signal generator output level until the test set meter reads 0.2 volts ac (20 dB down from 2 volts ac). Move the portable test set MULT switch to the 0.2 V ac position if necessary.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 11. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less for a receiver without an rf preamplifier, or 0.25 uV or less for a receiver with an rf preamplifier.

1.2.2.2 Using Built-In Station Metering

NOTE

This section substitutes a separate ac voltmeter for the portable test set meter 11 position.

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. *Private-Line* stations must also be PL disabled.

Step 5. Set the range switch on an ac voltmeter to the 2 V ac position and connect the voltmeter across the speaker terminals of the built-in station meter kit. Adjust the station VOLUME control for 2 volts as indicated on the voltmeter.

NOTE

The built-in station metering kit incorporates a dc voltmeter, not an ac voltmeter.

Step 6. Connect an rf signal generator to the receiver input connector.

Step 7. Set the signal generator controls as follows:

- Set up the signal generator to produce a CW or unmodulated signal.
- Set the generator output level to maximum.
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until meter position 4 reads exactly zero.

Step 8. Slowly decrease the signal generator output level until the ac voltmeter reads 0.2 volts ac. Move the ac voltmeter switch to the 0.2 V ac position if necessary.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 9. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less for a receiver without an rf preamplifier, or 0.25 uV or less for a receiver with an rf preamplifier.

1.3 TROUBLESHOOTING

1.3.1 Visual Inspection

1.3.1.1 The first step in the troubleshooting procedure should be a thorough visual inspection of the receiver and, in particular, the receiver rf and i-f board. Corrosion and burned or damaged components are usually easily seen and may be the cause or a symptom of the receiver malfunction. Loose circuit board mounting screws, or a loose or improperly installed receiver shield are other easily found problems that can cause a considerable degradation in receiver performance.

1.3.1.2 After the "obvious" problems have been corrected, repeat the receiver rf and i-f board performance tests. If the tests still produce unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart. The troubleshooting chart provides a systematic procedure for isolation of the defective stage and component.

1.3.1.3 As much information as possible has been included on the troubleshooting chart. However, you will have to refer occassionally to the receiver rf and i-f schematic diagram and circuit board detail. Detailed procedures regarding alignment, integrated circuits, and AFC troubleshooting, receiver gain measurements, and crystal dip tests follow in the text of this section of the manual.

1.3.2 Alignment as a Troubleshooting Technique

Low test set readings, improper discriminator output, and otherwise abnormal performance are very often corrected by realignment. Therefore, alignment should be one of the first troubleshooting steps performed for these symptoms.

1.3.3 Troubleshooting Integrated Circuits

1.3.3.1 Integrated circuits (ICs) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

1.3.3.2 The ICs on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in the following table.

Nominal Receiver Integrated Circuit DC Voltages (All readings are in volts dc, measured with respect to chassis)

Pin No.	IC101 Voltage	IC102 Voltage
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE

All voltages may vary ±10% from nominal readings shown.

1.3.4 Troubleshooting the AFC

To check AFC operation, perform the following test:

Step 1. Connect the Motorola test set (or use built-in metering if so equipped) to monitor discriminator output (meter position 4).

Step 2. Connect an rf signal generator to the receiver input connector. Set up the generator to provide about 100 uV of unmodulated signal at the selected receive channel frequency.

Step 3. Insert a screwdriver or other shorting device through the AFC OFF hole in the receiver shield, shorting the plating beneath the hole to the receiver shield, and adjust the input signal frequency for a discriminator meter indication of approximately 6 uA off zero center scale.

Step 4. Remove the short circuit. The test set meter indication should return to within 3 uA of zero center scale. If it does not, the AFC is malfunctioning.

Step 5. If the AFC is malfunctioning, either components on the receiver rf and i-f board or AFC circuitry in the channel element may be defective.

- The board may be checked by tracing the AFC error voltage from the discriminator output to the channel element. Performing step 3 and removing the short circuit should produce an error voltage of approximately 0.6 V dc (+ or − with respect to chassis, depending upon direction of the zero center offset) when measured with a voltmeter which has a minimum of 11 megohms input impedance. Check for this error voltage at P904-15, P904-14, P904-7 and at the AFC OFF plating near the channel element.

- The AFC channel element may be checked by substituting a known good channel element.

1.3.5 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every filter crystal has a good conductive path to ground. An ohmmeter test should indicate less than 1 ohm between the crystal case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure. Complete receiver rf and i-f alignment is given in the receiver alignment paragraphs of this instruction manual. Leave alignment test equipment connected to perform this check.

Step 2. Refer to the following table of receiver gain measurements, the receiver rf and i-f schematic diagram, and the receiver rf and i-f circuit board detail.

NOTE

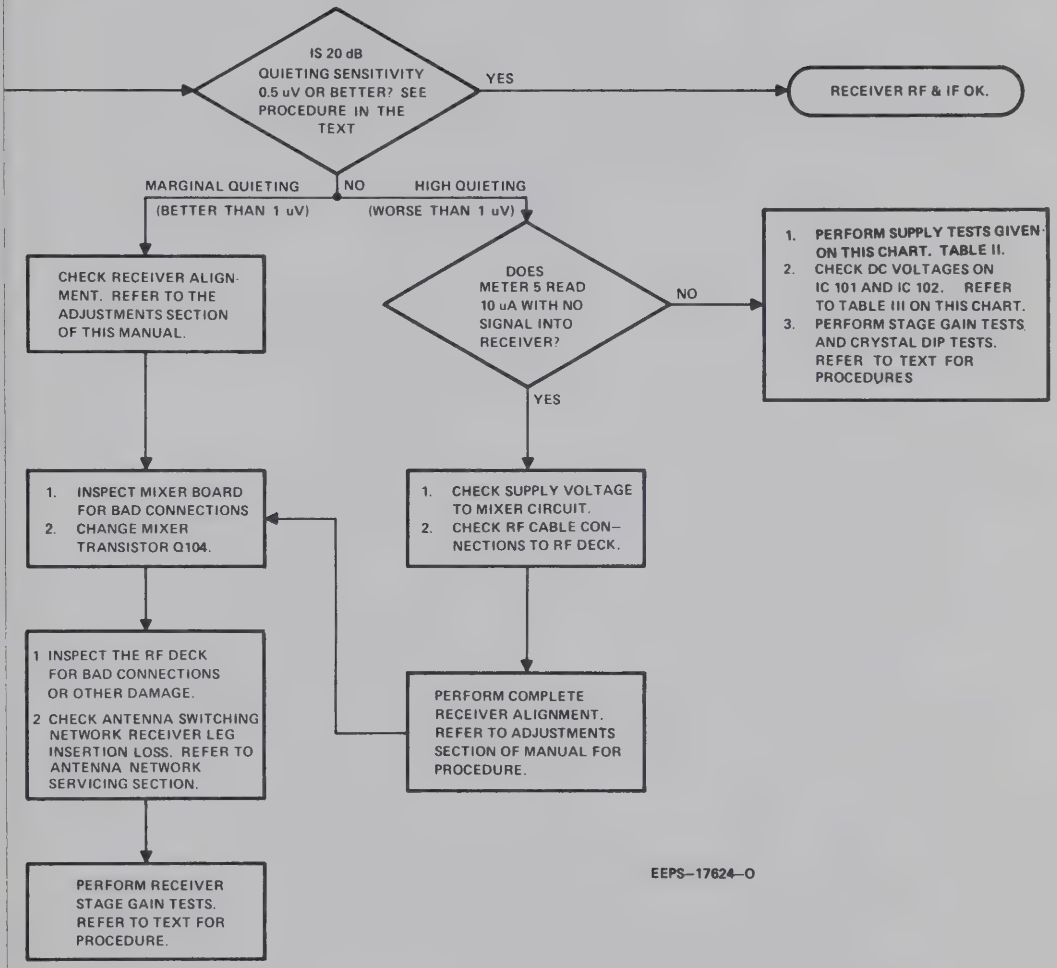
Receiver rf input voltages given in the table are those at the receiver input connector. If a pad or other attenuator is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

Examples:

6 dB loss means V out of the pad = 1/2 V into the pad.

20 dB loss means V out of the pad = 1/10 V into the pad.

CHART


IS 20 dB QUIETING SENSITIVITY 0.5 uV OR BETTER? SEE PROCEDURE IN THE TEXT
YES
RECEIVER RF & IF OK.
NO
MARGINAL QUIETING (BETTER THAN 1 uV)
HIGH QUIETING (WORSE THAN 1 uV)
CHECK RECEIVER ALIGNMENT. REFER TO THE ADJUSTMENTS SECTION OF THIS MANUAL.
DOES METER 5 READ 10 uA WITH NO SIGNAL INTO RECEIVER?
NO
1. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
2. CHECK DC VOLTAGES ON IC 101 AND IC 102. REFER TO TABLE III ON THIS CHART.
3. PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES
YES
1. INSPECT MIXER BOARD FOR BAD CONNECTIONS
2. CHANGE MIXER TRANSISTOR Q104.
1. CHECK SUPPLY VOLTAGE TO MIXER CIRCUIT.
2. CHECK RF CABLE CONNECTIONS TO RF DECK.
1 INSPECT THE RF DECK FOR BAD CONNECTIONS OR OTHER DAMAGE.
2 CHECK ANTENNA SWITCHING NETWORK RECEIVER LEG INSERTION LOSS. REFER TO ANTENNA NETWORK SERVICING SECTION.
PERFORM COMPLETE RECEIVER ALIGNMENT. REFER TO ADJUSTMENTS SECTION OF MANUAL FOR PROCEDURE.
PERFORM RECEIVER STAGE GAIN TESTS. REFER TO TEXT FOR PROCEDURE.
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Receiver RF & I-F
Troubleshooting Chart
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should be one of the first troubleshooting steps performed for these symptoms.

1.3.3 Troubleshooting Integrated Circuits

1.3.3.1 Integrated circuits (ICs) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

1.3.3.2 The ICs on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in the following table.

Nominal Receiver Integrated Circuit DC Voltages (All readings are in volts dc, measured with respect to chassis)

Pin No.	IC101 Voltage	IC102 Voltage
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE

All voltages may vary ±10% from nominal readings shown.

1.3.4 Troubleshooting the AFC

To check AFC operation, perform the following test:

Step 1. Connect the Motorola test set (or use built-in metering if so equipped) to monitor discriminator output (meter position 4).

Step 2. Connect an rf signal generator to the receiver input connector. Set up the generator to provide about 100 uV of unmodulated signal at the selected receive channel frequency.

Step 3. Insert a screwdriver or other shorting device through the AFC OFF hole in the receiver shield, shorting the plating beneath the hole to the receiver shield, and adjust the input signal frequency for a discriminator meter indication of approximately 6 uA off zero center scale.

Step 4. Remove the short circuit. The test set meter indication should return to within 3 uA of zero center scale. If it does not, the AFC is malfunctioning.

Step 5. If the AFC is malfunctioning, either components on the receiver rf and i-f board or AFC circuitry in the channel element may be defective.

- The board may be checked by tracing the AFC error voltage from the discriminator output to the channel element. Performing step 3 and removing the short circuit should produce an error voltage of approximately 0.6 V dc (+ or − with respect to chassis, depending upon direction of the zero center offset) when measured with a voltmeter which has a minimum of 11 megohms input impedance. Check for this error voltage at P904-15, P904-14, P904-7 and at the AFC OFF plating near the channel element.

- The AFC channel element may be checked by substituting a known good channel element.

1.3.5 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every filter crystal has a good conductive path to ground. An ohmmeter test should indicate less than 1 ohm between the crystal case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure. Complete receiver rf and i-f alignment is given in the receiver alignment paragraphs of this instruction manual. Leave alignment test equipment connected to perform this check.

Step 2. Refer to the following table of receiver gain measurements, the receiver rf and i-f schematic diagram, and the receiver rf and i-f circuit board detail.

NOTE

Receiver rf input voltages given in the table are those at the receiver input connector. If a pad or other attenuator is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

Examples:

6 dB loss means V out of the pad = 1/2 V into the pad.

20 dB loss means V out of the pad = 1/10 V into the pad.

RECEIVER RF AND IF TROUBLESHOOTING CHART

TROUBLESHOOTING PREREQUISITIES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. TURN STATION ON.
3. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS:
   - A. CONNECT THE ADAPTER CABLE 20–PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   - B. CONNECT THE ADAPTER CABLE RED "CONTROL" PLUG TO THE RECEPTACLE J3 ON THE UNIFIED CHASSIS INTERCONNECT BOARD.
   - C. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
4. SET PORTABLE TEST SET SWITCHES AS FOLLOWS:
   - A. FUNCTION SWITCH TO THE RCVR POSITION
   - B. METER REVERSING SWITCH TO OFF POSITION
   - C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   - D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   - E. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
5. ON "PRIVATE–LINE" RADIOS, DISABLE THE PL DECODER BY SETTING THE PL SWITCH ON THE STATION CONTROL MODULE TO THE DISABLE POSITION.
6. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
7. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.

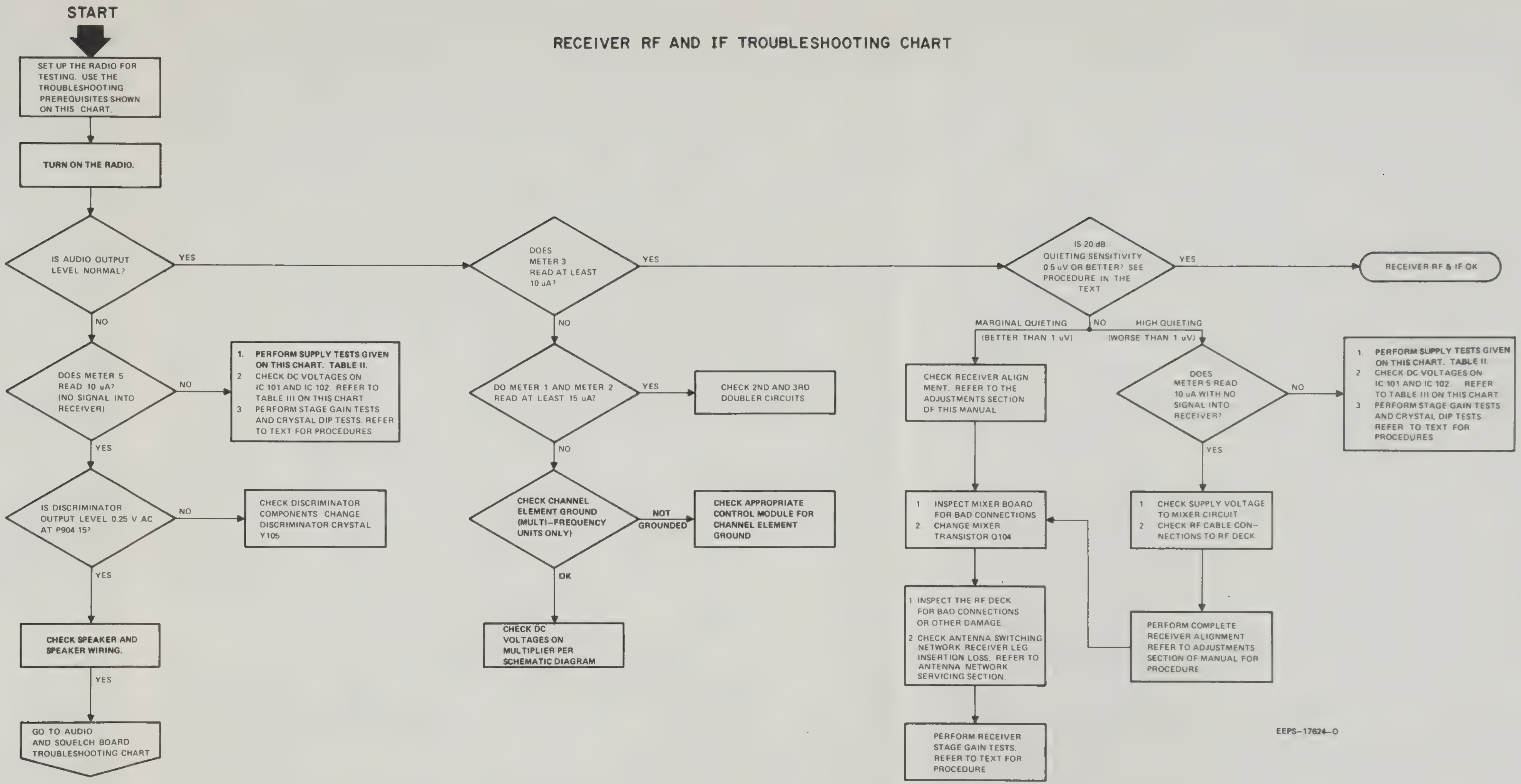

START
SET UP THE RADIO FOR TESTING. USE THE TROUBLESHOOTING PREREQUISITES SHOWN ON THIS CHART.
TURN ON THE RADIO.
IS AUDIO OUTPUT LEVEL NORMAL?
YES
NO
DOES METER 5 READ 10 uA? (NO SIGNAL INTO RECEIVER)
NO
1. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
2 CHECK DC VOLTAGES ON IC 101 AND IC 102. REFER TO TABLE III ON THIS CHART
3 PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES
YES
IS DISCRIMINATOR OUTPUT LEVEL 0.25 V AC AT P904 15?
NO
CHECK DISCRIMINATOR COMPONENTS CHANGE DISCRIMINATOR CRYSTAL Y105
YES
CHECK SPEAKER AND SPEAKER WIRING.
YES
GO TO AUDIO AND SQUELCH BOARD TROUBLESHOOTING CHART
DOES METER 3 READ AT LEAST 10 uA?
YES
NO
DO METER 1 AND METER 2 READ AT LEAST 15 uA?
YES
CHECK 2ND AND 3RD DOUBLER CIRCUITS
NO
CHECK CHANNEL ELEMENT GROUND (MULTI–FREQUENCY UNITS ONLY)
NOT GROUNDED
CHECK APPROPRIATE CONTROL MODULE FOR CHANNEL ELEMENT GROUND
OK
CHECK DC VOLTAGES ON MULTIPLIER PER SCHEMATIC DIAGRAM
IS 20 dB QUIETING SENSITIVITY 0.5 uV OR BETTER? SEE PROCEDURE IN THE TEXT
YES
RECEIVER RF & IF OK
NO
MARGINAL QUIETING (BETTER THAN 1 uV)
HIGH QUIETING (WORSE THAN 1 uV)
CHECK RECEIVER ALIGNMENT. REFER TO THE ADJUSTMENTS SECTION OF THIS MANUAL
1 INSPECT MIXER BOARD FOR BAD CONNECTIONS
2. CHANGE MIXER TRANSISTOR Q104
1 INSPECT THE RF DECK FOR BAD CONNECTIONS OR OTHER DAMAGE
2 CHECK ANTENNA SWITCHING NETWORK RECEIVER LEG INSERTION LOSS. REFER TO ANTENNA NETWORK SERVICING SECTION.
PERFORM RECEIVER STAGE GAIN TESTS. REFER TO TEXT FOR PROCEDURE
DOES METER 5 READ 10 uA WITH NO SIGNAL INTO RECEIVER?
NO
1. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
2 CHECK DC VOLTAGES ON IC 101 AND IC 102. REFER TO TABLE III ON THIS CHART
3 PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS REFER TO TEXT FOR PROCEDURES
YES
1 CHECK SUPPLY VOLTAGE TO MIXER CIRCUIT
2 CHECK RF CABLE CON–NECTIONS TO RF DECK
PERFORM COMPLETE RECEIVER ALIGNMENT REFER TO ADJUSTMENTS SECTION OF MANUAL FOR PROCEDURE
EEPS–17624–O

TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO-AMPS)	CIRCUIT METERED
1	15	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	15	SECOND DOUBLER OUTPUT
4	0±2	DISCRIMINATOR OUTPUT
5	10	SECOND I–F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

TEST POINT	DESCRIPTION
P904-9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904-11	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V).
P904-8	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	IC101 VOLTAGE	IC102 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: ALL VOLTAGES MAY VARY ±10% FROM NOMINAL READINGS SHOWN

Receiver RF & I-F
Troubleshooting Chart
Motorola No. EEPS-17624-O
2/15/83- UP

Receiver Gain Measurements

Test Point (See rf & i-f circuit board detail)	Receiver Input Voltage (preset)	Test Point Voltage ±6 dB	Remarks
A	16 mV	100 mV	
B	8 mV	50 mV	
C	10 mV	50 mV	
D	15 mV	50 mV	
E	12 mV	50 mV	
F	15 mV	50 mV	
G	10 mV	600 mV	IC101 saturated output
H	6 uV	100 mV	
I	9 uV	100 mV	
J	12 uV	100 mV	
K	11 uV	100 mV	
L	20 uV	100 mV	
M	1 uV	750 mV	IC102 saturated output

Step 3. Set the signal generator output frequency to the receiver channel frequency ("0" reading on meter 4). Adjust the signal generator output to provide the required receiver input voltage for a particular test point as listed in the table. Then, using an rf voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. At every test point the measured voltage should be within ±6 dB of the value given in the table.

Step 4. A high or low test point voltage measurement *may* indicate that the crystal at or ahead of the test point is defective. However, it may also indicate that an associated circuit component is defective. The extremly high-Q crystals used in *Micor Compa-Station* and Upright radios are very sensitive to associated circuit components. For example, if L125 is defective, it might appear that Y102 is bad. To isolate the defective component, perform the crystal dip tests described in the following procedure.

1.3.6 Crystal Dip Test

1.3.6.1 A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

1.3.6.2 The monolithic crystals used in *Micor* receivers are made up of two separate resonators on a single quartz blank. Each crystal has a pair of characteristic operating frequencies. One way to find the characteristic frequencies of each crystal is to short the crystal output to chassis ground, then monitor the crystal input voltage with an rf voltmeter while varying the signal generator frequency across the bandpass of the receiver. Low voltage points will occur at each of the crystal characteristic frequencies.

1.3.6.3 Figures 1 and 2 are plots of typical rf voltmeter readings obtained while testing good crystals. Note that the horizontal scales are calibrated in frequency, with f_o the channel frequency of the receiver. The vertical scales represent *relative* rf voltmeter readings. The bottom line is zero and the top line is maximum. Notice that each plot has a sharp minimum point above f_o and another below f_o. The table of crystal dip frequencies at the end of this section lists the frequencies at which these dip points should appear. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective.

Step 1. Leave the test equipment set up as was done for the receiver gain measurements.

Step 2. If the receiver uses AFC, disable the AFC by connecting a jumper between test point "N" (see receiver rf & i-f circuit board detail diagram) and chassis ground.

Step 3. Set the signal generator to f_o, the receiver channel frequency ("0" on meter 4). Adjust the generator output control for at least 50 mV *at the receiver input connector*.

Step 4. Refer to the crystal dip frequency table. To test a particular crystal, find it in the table, ground the indicated test point, and connect an rf voltmeter between the monitored test point and a nearby chassis ground point.

Step 5. Starting at f_o, *slowly increase* the signal generator frequency while watching for a dip in the rf voltmeter reading. This dip should be sharp, so increase the signal generator frequency very slowly and watch the rf voltmeter closely. When the dip is found, write down the frequency counter reading.

Step 6. Return the signal generator to f_o. Then watch the rf voltmeter while *slowly decreasing* the signal generator frequency. When the dip is found, write down the frequency counter reading.

Step 7. Compare your test results with the frequencies and tolerances listed in the table for the crystal you have tested. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective. Continue with this procedure to isolate the bad component.

Step 8. FOR TEST PURPOSES ONLY, exchange the suspected crystal with another from the receiver. Be sure you note the polarity of the crystal when you make the change. Repeat the receiver gain measurement and crystal dip test on the suspected crystal in the new location. If the suspected crystal tests bad again, consider it defective and replace it. If the crystal tests good, look for defective associated components at the original crystal location.

Step 9. When the tests are completed, be sure *all* jumpers are connected during the test are removed and that any *moved crystals are returned to their original locations.* Refer to the parts list and circuit board detail for correct part location. Note crystal polarity when replacing crystals.

Crystal Dip Frequencies

Crystal	Test Point Grounded	Test Point Monitored	+ Frequency Dip (kHz) ± 2.5 kHz	− Frequency Dip (kHz) ± 2.5 kHz
Y101	C	B	4.35	9.4
Y102	E	D	4.35	9.4
Y103	I	H	4.35	9.4
Y104	K	J	4.35	9.4

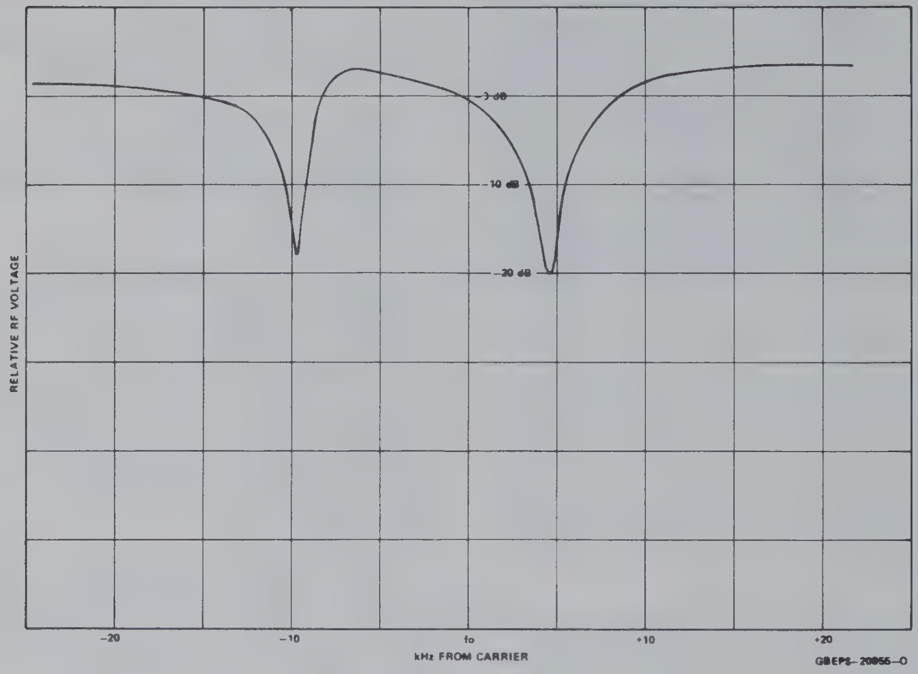


Figure 1.
Typical Plot of a Known Good Crystal in Position Y101 or Y103

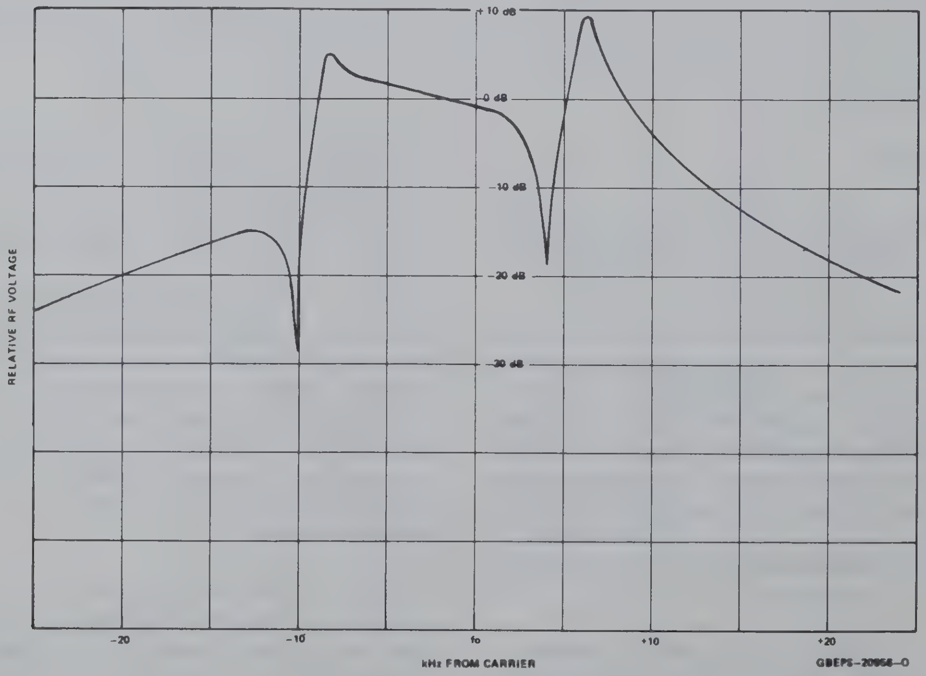


Figure 2.
Typical Dip Plot of a Known Good Crystal in Position Y102 or Y104

MOTOROLA INC.
Communications
Sector

FLAT AUDIO & SQUELCH BOARD

MODEL TRN5716A

1. DESCRIPTION

1.1 The audio and squelch board performs two basic functions — audio amplification and audio squelching. The first two stages in the audio circuitry amplify the signal from the discriminator and provide the proper frequency response. This signal is routed to the line driver module in remote control stations and to the local logic board in local control models. The audio returns through a VOLUME control. The remaining stages in the audio circuitry take the signal returning from the line driver and VOLUME control and provide the necessary frequency response at the speaker. These latter stages also provide the driver required by the final audio amplifiers (located on a separate board) for rated power output. An integrated circuit and one transistor perform all of the above functions.

1.2 The squelch circuitry disables the audio path during intervals between received messages. One integrated circuit performs the necessary detection and squelching functions. Also, in conjunction with the PL decoder and filter board in a PL station, this integrated circuit provides unsquelching when PL signals are received.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 The audio signal from the receiver discriminator is routed to the emitter follower (refer to Figure 1). The emitter follower output is coupled to the SQUELCH control mounted on the receiver chassis or local front panel and also to the line level potentiometer mounted on the audio & squelch board. The signal from this control is next applied to the preamplifier. If JU201 is cut, the signal is first sent through the PL filter for attenuation of the PL tone. The preamplifier output is coupled off the board to the line driver or local-logic board. Audio returning from the line driver or local-logic board is coupled through the appropriate VOLUME control to amplifier Q203. After amplification, the signal is applied to the audio amplification circuits. Here, the signal is raised to a level sufficient to drive the audio final amplifier. These are mounted on a separate board which is secured to the chassis to provide "heat sinking" capability. The output of the audio power amplifiers is applied to an output transformer which drives a speaker or speaker desk-set transformer (local control stations only).

2.1.2 The signal returned from the SQUELCH control is applied to the squelch section for noise squelch control. Squelch action is achieved by utilizing the inherent characteristic of a discriminator known as noise quieting. An input signal causes more quieting of noise as the signal level is increased. When a desired level of noise quieting is reached, as determined by the squelch circuitry and the setting of the SQUELCH control, the audio portion of the board and line driver are enabled to allow a message to be heard. In a remote control station, the squelch circuit disables the audio circuitry by shunting a point in the audio signal path to ground and also operating a series switch in the audio signal path of the line driver.

2.1.3 In a local control station, the series path is broken on the local-logic board. In addition, an *extra* shunt switch is activated on this board and its low resistance is directed back to the audio amplification circuits. This provides extremely quiet operation during periods of no signal.

2.1.4 Upon completion of a received message, audio shut-off is either immediate or automatically delayed 150 milliseconds, depending upon the signal level of the previously received rf carrier. A strong signal produces the immediate shut-off and prevents an annoying, loud "squelch tail" burst from being heard. Weak signals (signals that produce less than 20 dB noise quieting) produce the long shut-off delay and prevent a message from being chopped under "flutter" conditions. Since the received signal level must be low for the long turn-off delay to occur and the "squelch tail" level is comparable to that of the received signal, the "squelch tail" is not annoying.

2.2 EMITTER FOLLOWER CIRCUIT

2.2.1 The emitter follower circuit provides a low impedance output which isolates the high impedance discriminator output from the following squelch and audio circuitry.

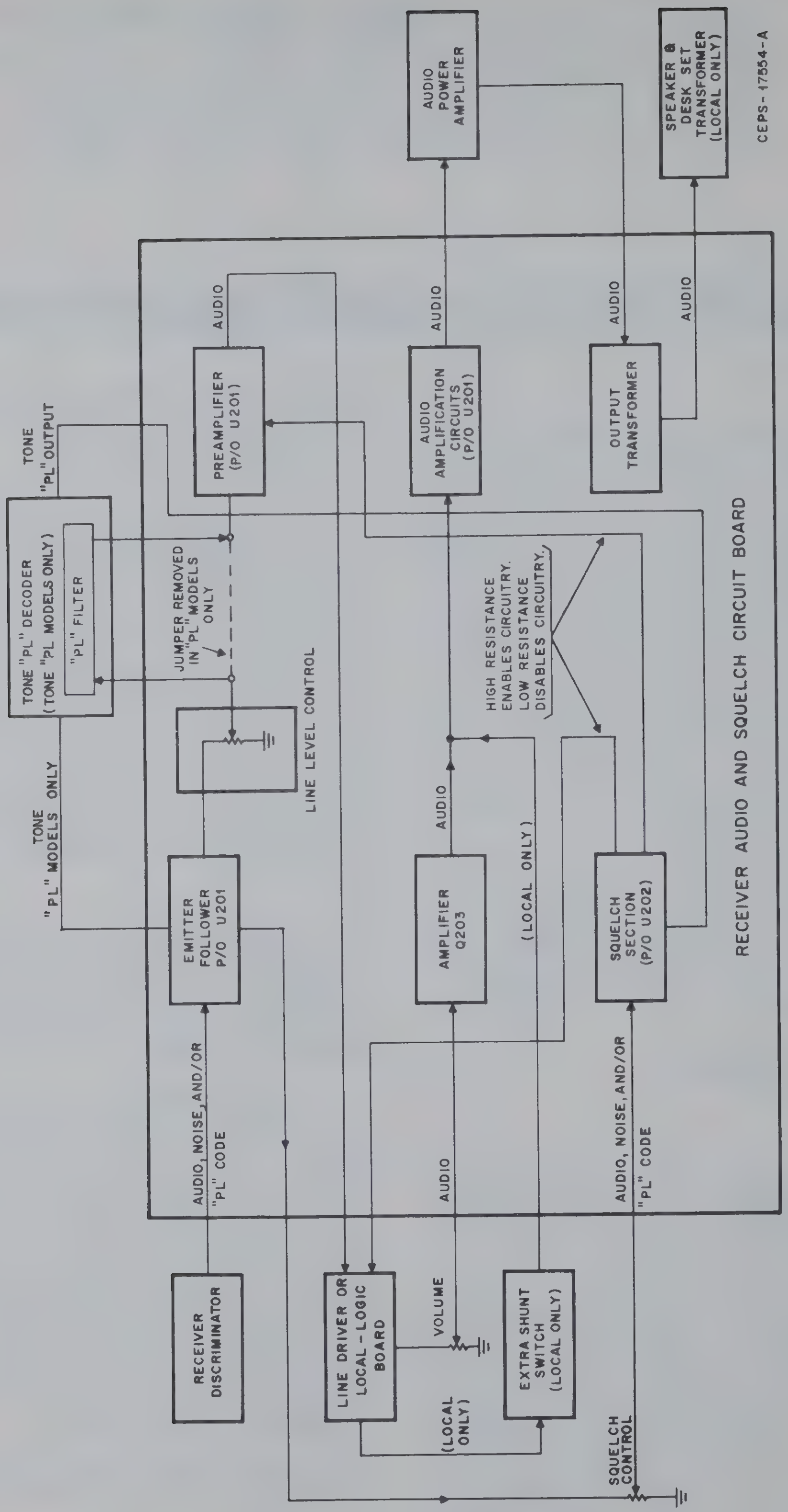

RECEIVER DISCRIMINATOR
AUDIO, NOISE, AND/OR "PL" CODE
EMITTER FOLLOWER P/O U201
TONE "PL" MODELS ONLY
LINE LEVEL CONTROL
JUMPER REMOVED IN "PL" MODELS ONLY
TONE "PL" DECODER (TONE "PL MODELS ONLY)
"PL" FILTER
TONE "PL" OUTPUT
PREAMPLIFIER (P/O U201)
AUDIO
LINE DRIVER OR LOCAL-LOGIC BOARD
VOLUME
AUDIO
AMPLIFIER Q203
AUDIO
AUDIO AMPLIFICATION CIRCUITS (P/O U201)
AUDIO
AUDIO POWER AMPLIFIER
HIGH RESISTANCE ENABLES CIRCUITRY. LOW RESISTANCE DISABLES CIRCUITRY.
(LOCAL ONLY)
EXTRA SHUNT SWITCH (LOCAL ONLY)
(LOCAL ONLY)
SQUELCH SECTION (P/O U202)
AUDIO, NOISE, AND/OR "PL" CODE
SQUELCH CONTROL
OUTPUT TRANSFORMER
AUDIO
AUDIO
SPEAKER & DESK SET TRANSFORMER (LOCAL ONLY)
RECEIVER AUDIO AND SQUELCH CIRCUIT BOARD
CEPS-17554-A

Figure 1. Audio and Squelch Block Diagram

2.2.2 The output of the discriminator is capacitively coupled to the emitter follower input at U201-1 and may consist of noise and audio signals. The output of the emitter follower at U201-2 is routed through C207 to the SQUELCH control.

2.3 PREAMPLIFIER CIRCUIT

This circuit amplifies the low-level audio signal to provide the drive necessary for proper line driver operation. In addition, a negative feedback network (C208 and C209) provides the necessary frequency response characteristics for phone line operation. In PL stations, jumper JU202 is cut and the negative feedback is provided by R237 only. The network of R210 and C210 provides additional frequency response shaping.

2.4 AMPLIFIER CIRCUIT

Transistor C203 increases the signal level from the line driver or local-logic board to the level required by the audio amplification circuits. Jumper JU203 is out when the equipment leaves the factory. The gain of Q203 is sufficient to drive the audio amplification circuits if the signal strength from the line driver or squelch gate exceeds −10 dBm. With a signal strength below this level, it is advisable to put in JU203 which increases the gain of C203. The RC network at the input to this stage provides additional frequency response shaping required at the speaker.

2.5 AUDIO AMPLIFICATION CIRCUIT

2.5.1 The signal from amplifier Q203 is applied to the differential amplifier through capacitors C211 and C213. In a local station, the extra shunt switch on the local-logic board is connected to the junction of C211 and C213.

2.5.2 The differential amplifier output provides the drive for the complementary amplifier. Resistors R221 and R220 form a voltage divider biasing the differential amplifier at one-half of the supply voltage. Undesirable transient voltages are eliminated by capacitor C212.

2.5.3 Final audio amplification on the audio and squelch board occurs in the complementary amplifier. These stages provide the drive for the audio power amplifiers which are mounted on a separate board. The complementary amplifier emitter resistors (R218 and R219) are not included in U201 because of their high heat dissipation requirements.

2.5.4 Audio returned to the audio and squelch board (from the audio power amplifier transistors) is applied to the output transformer primary windings. This transformer consists of four windings — two input primaries, an output secondary, and a feedback secondary. The output secondary winding couples audio power to an external 8-ohm speaker which can be driven with up to 10 watts at less than 5% distortion. Negative feedback from the output transformer winding through C216 and across R211 gives 6 dB per octave de-emphasis (roll-off) to the audio which has been pre-emphasized 6 dB per octave in the transmitter. Below 300 Hz, feedback from R213 and across C215 increases giving low frequency de-emphasis. Capacitor C238 rolls off the high frequency gain of the amplifier to prevent high frequency oscillation. Capacitors C223 and C224, C240, C241, and C242 are rf bypass capacitors that shunt stray rf on the audio A+ and audio A− lines to ground. In local operation the output secondary winding couples audio power to a 16-ohm speaker and an autotransformer. This transformer can drive up to six local desk sets.

2.6 NOISE ACTIVATED SQUELCH CIRCUIT

2.6.1 Squelch Input Circuit

2.6.1.1 The input signal from the SQUELCH control may consist of audio and noise. An input shaping network precedes U202 and passes high frequencies while attenuating low frequencies. Allowing the high frequencies to pass eliminates the effect of voice and results in more sensitive threshold squelch action.

2.6.1.2 The first amplifier and limiter is driven into limit by its input signal and prevents audio from squelching (disabling) the audio channel on voice signals. Amplified, limited noise is then passed through a coupling network to the second amplifier. This coupling network is also a high pass filter which further attenuates voice and tone signals to the second amplifier.

2.6.1.3 The second amplifier amplifies the noise signal and applies it through an RC coupling network to the detector. Capacitor C233 and C234 form another high pass filter that attenuates the low frequencies. Capacitor C234 is used to produce a peak-to-peak detector action from the noise detector, and thus, generate twice the output voltage of a peak detector. This capacitor does not affect frequency response.

2.6.2 Detector and Switching Circuits

2.6.2.1 The detector output level is a function of received signal strength and the setting of the SQUELCH control. The detector develops the dc output voltage across filter capacitor C235. The lowest dc output voltage corresponds to a no signal input (maximum noise) condition. The output voltage increases as the received rf carrier signal level increases (noise decreases).

2.6.2.2 The primary function of the detector output, however, is the control of shunt switching. This is done by applying the detector output to three squelch control circuits simultaneously.

- long ‘‘squelch tail’’ circuit
- long ‘‘squelch tail’’ defeat switch
- carrier squelch switching logic

2.6.2.3 With no received rf carrier signal (maximum noise condition), the long "squelch tail" circuit and long "squelch tail" defeat switch are "off" and the carrier squelch switching logic is "on". The audio channel is subsequently disabled unless the squelch control logic is overridden by other circuitry.

2.6.2.4 As the input signal level increases (noise decreases), the detector output voltage increases. A detector output voltage above 2.8 volts dc results in enabling of the long "squelch tail" circuit. The long "squelch tail" circuit produces a voltage at U202-12 of 5.5 volts dc; this voltage causes the carrier squelch switching logic circuit to turn "off" and thereby enables the audio channel. Capacitor C236 and resistor R235 provide a rapid-rise, slow-decay time constant to the voltage applied to the carrier squelch switching logic circuit. This permits a weak signal to immediately enable the audio channel, yet delays the audio channel shut-off if the signal is in a "flutter" condition. The voltage necessary to enable the carrier squelch switching logic is approximately 3.8 volts dc.

2.6.2.5 A voltage greater than 5 volts dc at the detector output (rf carrier signal level that produces 20 dB quieting or better with the SQUELCH control set at threshold), turns on the long "squelch tail" defeat switch. This disables the long "squelch tail" circuit and the 150 millisecond delay function. Audio channel disabling now occurs immediately after the rf carrier disappears.

2.6.3 Squelch Output Circuit

The squelch control logic circuit directly controls the shunt switches.

2.6.3.1 The output of the squelch control logic circuit depends upon the output of the preceding carrier squelch switching logic circuit. With the carrier squelch switching logic circuit "off", the squelch control logic circuit turns off the shunt switches, allowing a message to be heard. If the carrier squelch switching logic is "on", the squelch control logic circuit will turn on the shunt switches, disabling the audio channel, and activating the series switches in the line driver or local-logic board. Capacitor C237, connected to U202-10, slows the turn-off of the shunt switches to "soften" what would otherwise be an annoyingly abrupt turn-on of the audio. This same point (U202-10) supplies a digital output voltage that can be used as an indicator that the receiver is unsquelched (audio channel enabled).

2.6.3.2 Two additional functions that may affect the squelch control logic output are associated with *Private-Line* operation. PL disable (U202-14) may be either shorted to ground or open. When an open is present at U202-14 (PL disabled), a received signal with or without a PL code is heard from the speaker. When at ground potential (PL enabled), the output of the carrier squelch switching logic circuit is inhibited. When the proper PL code is received, a positive 9.5 volts dc from the PL decoder board to U202-8 turns off the squelch control logic circuit which turns off the shunt switches and allows a message to be heard. Jumper JU204 is normally in the circuit and is only cut when a field modification is made. The cutting of this jumper *and associated modifications on the receiver interconnect board* provides "AND-SQUELCH" operation, changing the PL squelch circuitry from fixed sensitivity operation to variable sensitivity operation. Under this mode of operation, the SQUELCH control affects the squelch sensitivity.

2.6.3.3 Audio disabling is performed by shunting the audio circuit to ground through a low impedance path and also by the operation of a series switch in the line driver or local-logic board. When the solid state shunt switch is turned "on" (U202-7), signals developed across R236 are shunted to ground. This prevents any signals from being heard at the speaker. Acting in tandem with the first shunt switch, the second shunt switch output is routed to the line driver or local-logic board and enables a set of switches on either of the boards. In a remote control system, this breaks the audio path and prevents audio from appearing on the 600-ohm line. In a local control system, these series switches also break the audio path, thus preventing any audio or hum and noise from reaching the speaker.

3. MAINTENANCE

3.1 GENERAL

This section of the manual provides maintenance shop type procedures for the audio and squelch board. It assumes that preliminary tests have already localized the trouble to this board. These bench tests include procedures for testing and troubleshooting, including integrated circuit check-out.

NOTE

The audio and squelch board must be installed in a station for testing to provide the necessary power and ground connections.

3.2 PERFORMANCE TESTS

The performance tests may be used for troubleshooting to isolate the point of abnormal operation. They may also be used after repair to assure that the board is operating properly before it is returned to service.

3.2.1 Audio Amplification

3.2.1.1 Specifications

The audio section of the audio and squelch board combined with the separate audio power amplifier transistors will provide at least 10 watts (5 watts local) audio output at less than 5 percent distortion from a 3.0 kHz deviated, 1 kHz modulated on-frequency signal applied to the station antenna receptacle.

3.2.1.2 Procedure

Step 1. Replace the speaker with an 8-ohm, 15 watt non-inductive resistor. In local control stations, disconnect the autotransformer.

Step 2. Set the SQUELCH control fully counterclockwise (unsquelched). *Private-Line* stations must also be PL disabled.

Step 3. Connect an rf signal generator to the station antenna receptacle and adjust it to the receiver frequency.

Step 4. Adjust the signal generator for 1000 microvolt output, modulated with 1000 Hz tone at ±5.0 kHz deviation.

Step 5. Connect an ac voltmeter to pin J903-7 at the receiver interconnect board.

Step 6. Adjust the line level control R203 for 175 mV ac rms.

Step 7. Reduce the deviation to ±3.0 kHz.

Step 8. Connect an ac voltmeter across the 8-ohm resistor.

Step 9. Adjust the VOLUME control until 9.0 volts ac rms is read on the ac voltmeter (this represents 10 watts).

Step 10. Measure distortion at 10 watts audio power output. It should be less than 5 percent.

3.2.2 Squelch Control

3.2.2.1 Specifications

3.2.2.1.1 The squelch section of the receiver audio and squelch board should enable the audio section when an rf signal level greater than 6 dB noise quieting (one-half the discriminator output level with no signal input) is applied to the receiver with the SQUELCH control set at threshold. When the signal is removed from the station, the audio channel should become disabled after approximately 150 milliseconds. When an input signal greater than that required for approximately 20 dB noise quieting is removed from the station, the audio channel should become disabled immediately.

3.2.2.1.2 When the SQUELCH control is turned fully clockwise (tight squelch) an input signal that produces about 20 dB noise quieting should be required to enable the audio channel.

3.2.2.1.3 The squelch section should inhibit audio output when no input signal is received.

3.2.2.1.4 In *Private-Line* stations, the squelch section of the receiver's audio and squelch board should perform as described in paragraphs 3.2.2.1.1, 3.2.2.1.2, and 3.2.2.1.3 while the radio set is PL disabled.

3.2.2.1.5 In PL operation, the squelch section should inhibit audio output when the proper PL code is not received, regardless of the input signal strength.

3.2.2.2 Procedure

3.2.2.2.1 Carrier Squelch Stations

Step 1. Turn the station on and adjust the SQUELCH control clockwise from the full counterclockwise position until the receiver just quiets (threshold squelch).

Step 2. Measure the resistance of U202-6 and -7 with reference to ground. Both pins should be less than 1000 ohms.

NOTE

Erroneous readings are obtained in resistance measurements if the voltage between the ohmmeter probes exceeds approximately 5.0 volts dc.

Step 3. Connect a signal generator to the station antenna receptacle and adjust it to the receiver frequency. Modulate the generator output with a 1000 Hz tone at ±3.0 kHz deviation.

Step 4. Increase the signal generator output slowly until the receiver just unsquelches. Remove the modulation from the signal generator. Unsquelching should occur at a generator output that produces 6 dB noise quieting, or less.

Step 5. Measure the resistances of U202-6 and -7 with reference to ground. Both pins should be greater than 200,000 ohms.

Step 6. Increase the signal generator output until approximately 12 dB noise quieting is obtained. Remove the rf signal from the station input either by turning off the signal generator or by using a relay in series with the signal generator output. A long "squelch tail" should occur. If a calibrated, triggered sweep oscilloscope is available for measurement, the duration of the "squelch tail" should be approximately 150 milliseconds as measured at the speaker.

Step 7. Increase the signal generator output to produce 30 dB noise quieting. Turn off the rf signal and note the "squelch tail" duration. It should be no more than a "clock". The duration should be less than 10 milliseconds.

Step 8. Turn the SQUELCH control fully clockwise (tight squelch).

Step 9. Adjust the signal generator output level until the station just unsquelches. Unsquelching should occur at a generator output that produces approximately 20 dB noise quieting.

3.2.2.2.2 *Private-Line* Stations

Step 1. Disable the PL circuitry.

Step 2. Perform previously described carrier squelch station procedure.

Step 3. Return the station to PL operation. On stations using "AND" squelch operation, also turn the SQUELCH control fully counterclockwise during this test.

Step 4. Vary generator output between minimum output and 1000 microvolt output while checking the resistances of U202-6 and -7 with reference to ground. Both resistances should remain at less than 1000 ohms.

Step 5. Modulate the on-frequency generator output with a PL code for ±0.5 to ±1 kHz deviation and 1000 Hz tone for ±3.0 kHz overall deviation.

Step 6. Increase the signal generator output slowly until the receiver just squelches. Unsquelching should occur at a generator output that produces 6 dB quieting or less, for PL stations. For DPL stations, unsquelching should occur at a generator output that produces 8 dB quieting or less.

3.3 TROUBLESHOOTING

3.3.1 Check Input Voltages

A malfunction in the audio and squelch operation may be due to the loss of dc input voltages which can be caused by this board or another section of the station. Since there are only two input voltages applied to this board, it is advantageous to verify their presence before beginning extensive troubleshooting.

P903-1, -4	+9.6 V dc in respect to chassis
P903-16	Audio A+ (approximately +13.6 V dc in respect to A−)

In a negative ground system, audio A¬ is at chassis potential. In a positive ground system, audio A+ is at chassis potential.

3.3.2 Isolating Defective Components

If tests indicate abnormal performance, a logical troubleshooting procedure should be followed to isolate the defective component efficiently. Results of performance tests usually localize the malfunction to one or two stages. The accompanying troubleshooting chart summarizes these results in a logical sequence. A few waveforms, voltage and resistance checks in the suspected circuit should readily isolate the defective component when compared with those on the schematic diagram.

3.3.3 Troubleshooting Integrated Circuits

Integrated circuits (IC's) are very reliable components and should not be replaced until all checks have proven definitely that the IC is the defective component. Make sure that the external components in the circuit are normal. The IC's on the audio and squelch board may be checked by dc voltage measurements although signal tracing with an oscilloscope is preferred.

3.3.4 Stage Gain Measurements

3.3.4.1 Squelch Circuitry

3.3.4.1.1 This troubleshooting procedure may be used to isolate a squelch malfunction occuring before the detector to a specific stage. The test is performed by injecting an ac signal at the input to the squelch circuitry and noting results obtained with an ac voltmeter. Most accurate results are obtained by taking dB gain and loss measurements between points as illustrated in Figure 2. Individual point voltage checks may also be used to quickly verify proper squelch input circuitry operation but this is not an adequate test to prove the circuit is defective (refer to Table 1 and Figure 2). Tolerance addition *may* cause increasing variation from the typical readings in the table as readings are taken further from the injected signal point.

3.3.4.1.2 The following procedure may be used for loss and gain or signal level measurements while injecting a 3 kHz or 30 kHz signal. In *Private-Line* radios, PL operation does not affect this test.

Step 1. Turn the VOLUME control fully counterclockwise (off), or to a comfortable listening level, if desired.

Step 2. Turn the SQUELCH control fully clockwise (squelched) and turn the station on.

Step 3. Inject a 1000 microvolt, on-channel signal at the station antenna receptacle. This "quiets" the discriminator output and prevents erroneous test readings.

Step 4. Inject a 3 kHz, 10 millivolt rms signal at the receiver audio & squelch board at P903-9.

Step 5. Take loss and gain measurements or signal level measurements as required.

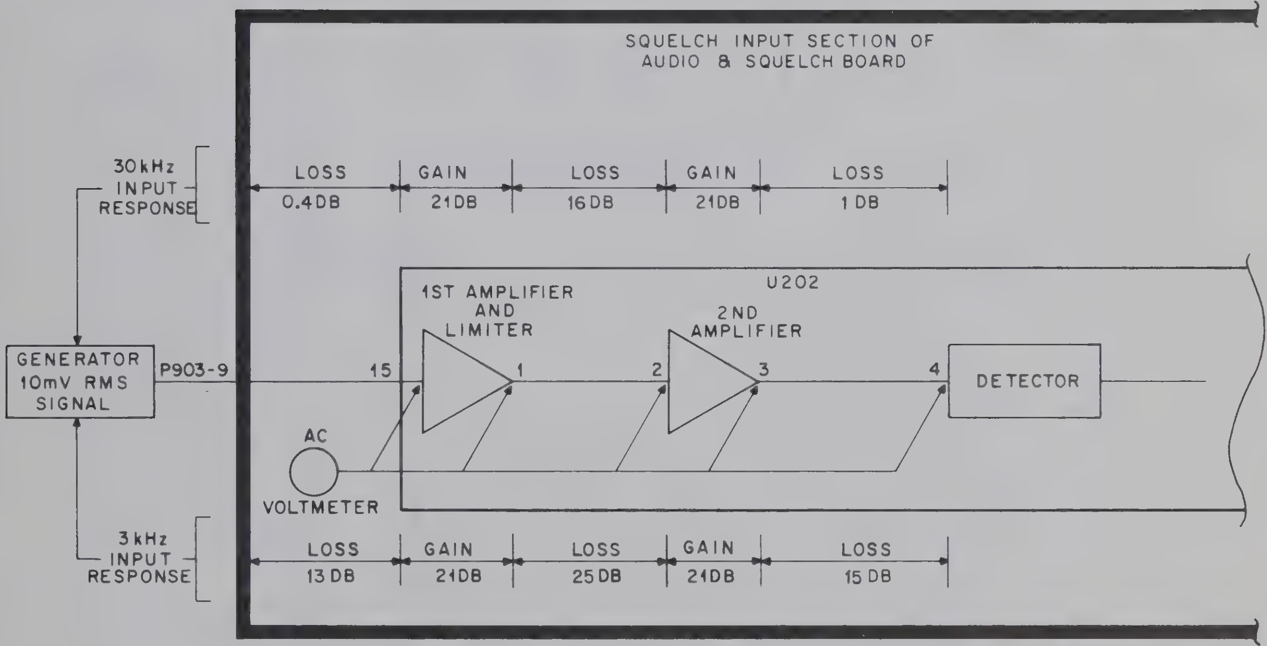
Step 6. Repeat the preceding test using a 30 kHz signal in place of the 3 kHz signal in Step 4.

3.3.4.2 Audio Circuitry

AC voltage measurements and waveforms are given where applicable on the schematic diagram. Refer to this diagram for pertinent information when taking audio stage gain measurements.

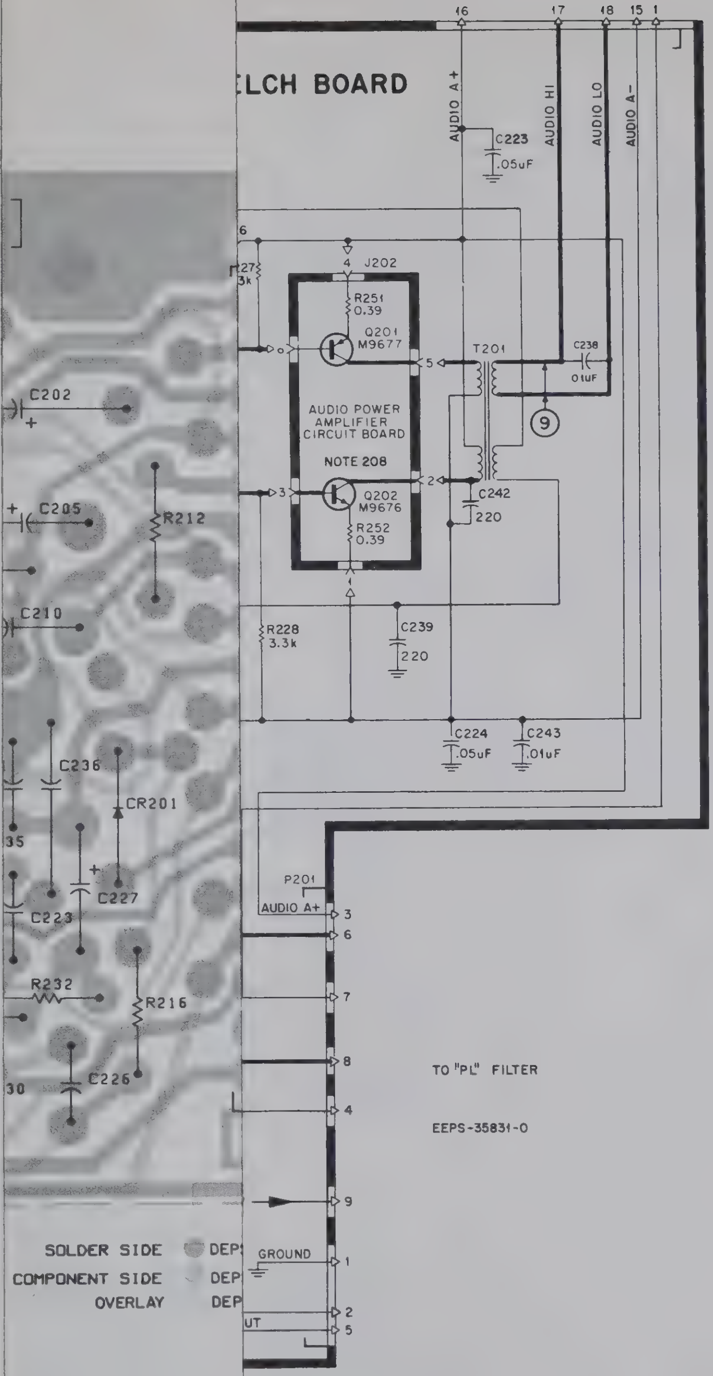
Table 1. Signal Level Measurements

AC Voltmeter Connected to U202-Pin	AC Voltmeter Reading With 3 kHz Signal Input (mV)	AC Voltmeter Reading With 30 kHz Signal Input (mV)
15	2.2	6.3
1	25.0	70.8
2	1.4	11.2
3	16.0	126.0
4	2.8	112.0


SQUELCH INPUT SECTION OF AUDIO & SQUELCH BOARD
30kHz INPUT RESPONSE
LOSS 0.4DB
GAIN 21DB
LOSS 16DB
GAIN 21DB
LOSS 1 DB
U202
1ST AMPLIFIER AND LIMITER
2ND AMPLIFIER
GENERATOR 10mV RMS SIGNAL
P903-9
15
1
2
3
4
DETECTOR
AC VOLTMETER
3kHz INPUT RESPONSE
LOSS 13 DB
GAIN 21DB
LOSS 25 DB
GAIN 21DB
LOSS 15 DB

CEPS-26104-0

Figure 2. Squelch Circuitry Stage Gain Measurements

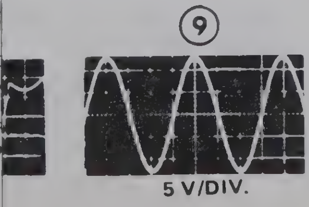

LCH BOARD
16
17
18
15
1
AUDIO A+
AUDIO HI
AUDIO LO
AUDIO A−
C223
.05uF
J202
R251
0.39
Q201
M9677
T201
C238
.01uF
AUDIO POWER AMPLIFIER CIRCUIT BOARD
NOTE 208
Q202
M9676
R252
0.39
C242
220
9
R228
3.3k
C239
220
C224
.05uF
C243
.01uF
P201
AUDIO A+
GROUND
UT
TO "PL" FILTER
EEPS-35831-O
C202
C205
R212
C210
C236
CR201
C227
C223
R232
R216
C226
35
30
SOLDER SIDE
COMPONENT SIDE
OVERLAY
DEP
DEP
DEP

NOTES:

201. +5.6 VOLTS WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH (I.E., APPROXIMATELY 6 dB QUIETING SIGNAL WITH SQUELCH CONTROL AT THRESHOLD).
202. WHERE MORE THAN ONE VOLTAGE READING APPEARS:
USQ= RECEIVER UNSQUELCHED
FSQ= RECEIVER FULLY SQUELCHED
203. VOLTAGE MEASURED WITH RESPECT TO A−.
204. VOLTAGE MEASURED WITH RESPECT TO A+.
205. VOLTAGES AT U201-6 AND -7 MUST BE THE SAME VALUE.
206. UNLESS OTHERWISE STATED:
CAPACITOR VALUES ARE IN PICOFARADS.
207. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES ±10% MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND.
208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD
209. JUMPER JU204 MUST BE REMOVED FOR "AND SQUELCH" OPERATION. (SEE "RECEIVER INTERCONNECT UNIT" SECTION). SEE JUMPER TABLE FOR JUMPER USE.

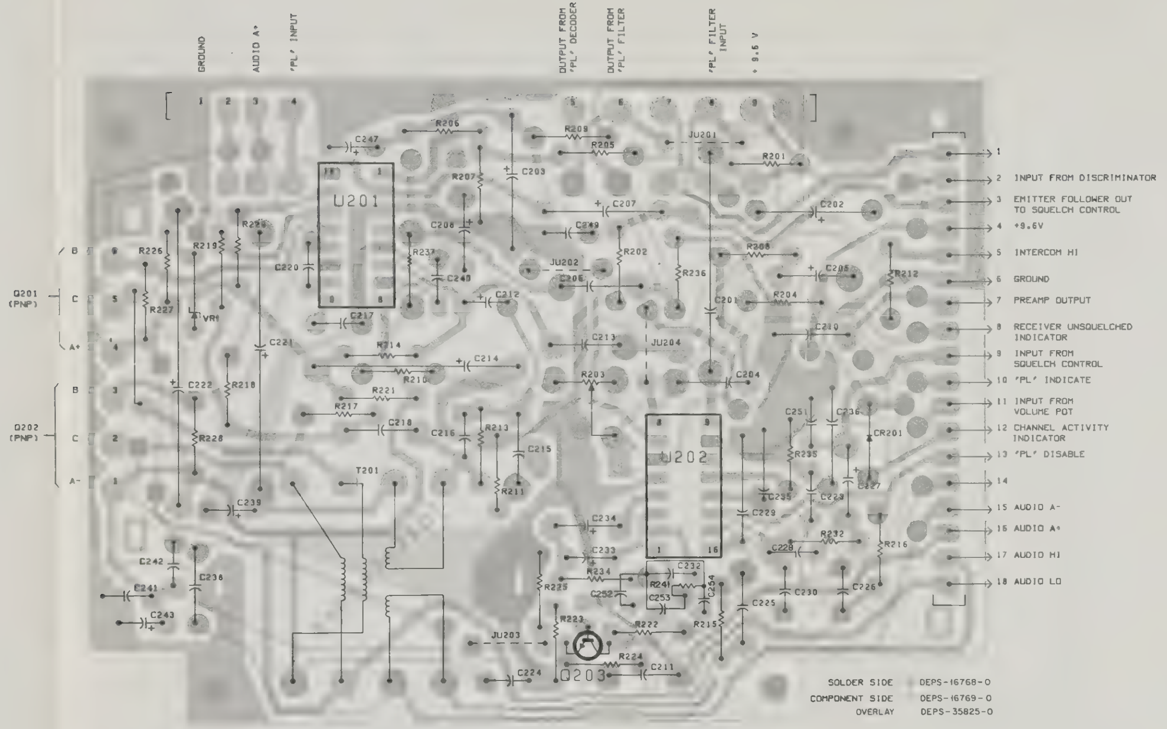
ALL AUDIO CIRC
TAKEN UNDER T

1. VERTICAL S
WAVEFORM
2. HORIZONTA
3. SQUELCH CO
WISE (OFF)
MODULATED
+3.0 kHz DEV
4. VOLUME CO
5. OUTPUT TER
6. R203 SET FO
DEVIATION

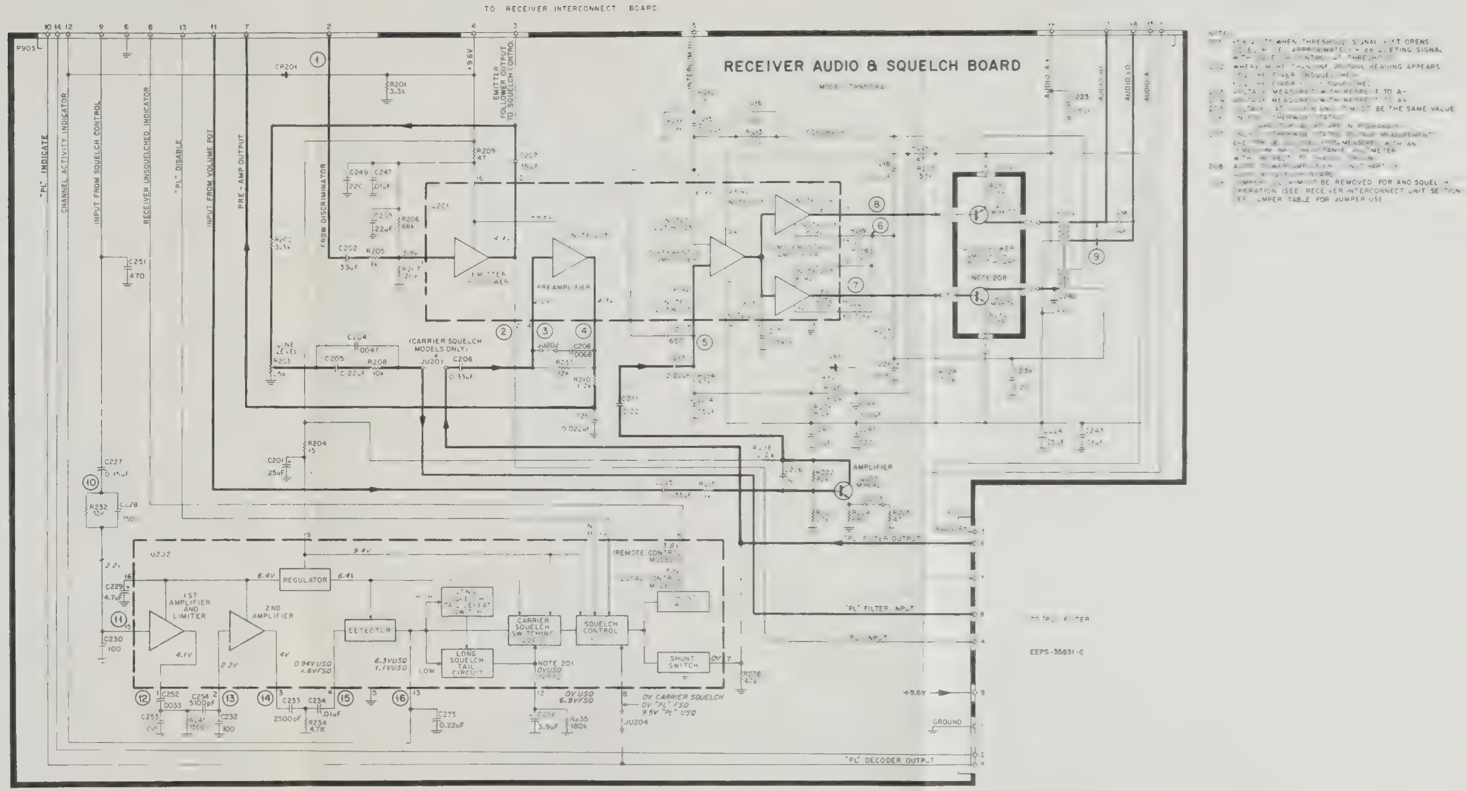


PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TRN5716A Audio and Squelch Board Schematic Diagram, Circuit Board Detail, and Troubleshooting Chart
Motorola No. PEPS-35824-O
(Sheet 1 of 2)
2/15/83- UP


GROUND
AUDIO A+
'PL' INPUT
OUTPUT FROM 'PL' DECODER
OUTPUT FROM 'PL' FILTER
'PL' FILTER INPUT
+ 9.6 V
1 2 3 4 5 6 7 8 9
U201
U202
Q201 (PNP)
Q202 (PNP)
Q203
T201
1
2 INPUT FROM DISCRIMINATOR
3 EMITTER FOLLOWER OUT TO SQUELCH CONTROL
4 +9.6V
5 INTERCOM HI
6 GROUND
7 PREAMP OUTPUT
8 RECEIVER UNSQUELCHED INDICATOR
9 INPUT FROM SQUELCH CONTROL
10 'PL' INDICATE
11 INPUT FROM VOLUME POT
12 CHANNEL ACTIVITY INDICATOR
13 'PL' DISABLE
14
15 AUDIO A-
16 AUDIO A+
17 AUDIO HI
18 AUDIO LO
SOLDER SIDE DEPS-16768-0
COMPONENT SIDE DEPS-16769-0
OVERLAY DEPS-35825-0

SHOWN FROM SOLDER SIDE

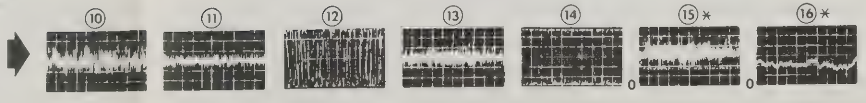

TO RECEIVER INTERCONNECT BOARD
RECEIVER AUDIO & SQUELCH BOARD
P903
'PL' INDICATE
CHANNEL ACTIVITY INDICATOR
INPUT FROM SQUELCH CONTROL
RECEIVER UNSQUELCHED INDICATOR
'PL' DISABLE
INPUT FROM VOLUME POT
PRE-AMP OUTPUT
FROM DISCRIMINATOR
+9.6V
EMITTER FOLLOWER OUTPUT TO SQUELCH CONTROL
INTERCOM HI
AUDIO A+
AUDIO HI
AUDIO LO
AUDIO A-
CR204
R201 3.3k
R209 47
C249
C247
EMITTER FOLLOWER
PREAMPLIFIER
(CARRIER SQUELCH MODELS ONLY)
AMPLIFIER
1ST AMPLIFIER AND LIMITER
2ND AMPLIFIER
REGULATOR
DETECTOR
LONG SQUELCH TAIL CIRCUIT
CARRIER SQUELCH SWITCHING
SQUELCH CONTROL
SHUNT SWITCH
REMOTE CONTROL
'PL' FILTER INPUT
'PL' INPUT
+9.6V
GROUND
'PL' DECODER OUTPUT
EEPS-35831-0

ALL SQUELCH CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER FOLLOWING CONDITIONS

1 VERTICAL SENSITIVITY = 0.5 V/DIV
2 HORIZONTAL DEFLECTION = 2 msec/DIV
3 SQUELCH CONTROL FULLY CLOCKWISE (ON) NO EXTERNAL SIGNAL APPLIED
*4. WAVEFORMS ⑮ AND ⑯ ARE DC COUPLED WITH ZERO AT BOTTOM, OTHERS AC COUPLED.

EPS-6534-O

SQUELCH CIRCUIT WAVEFORMS

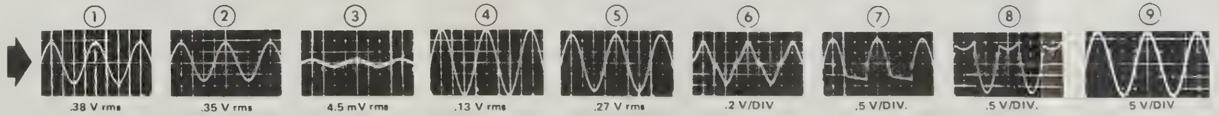


ALL AUDIO CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER THE FOLLOWING CONDITIONS

1 VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
2 HORIZONTAL DEFLECTION - 25 msec/DIV
3 SQUELCH CONTROL FULLY COUNTERCLOCKWISE (OFF) 1000 uV RF SIGNAL INPUT MODULATED WITH 1000 Hz TONE WITH +3.0 kHz DEVIATION
4 VOLUME CONTROL SET FOR 9.0 V rms AT LOAD
5 OUTPUT TERMINATED IN 8 OHM LOAD
6 R203 SET FOR 175 mV AT PIN 7 WITH +5 kHz DEVIATION (1 kHz TONE)

EPS 8804-O

AUDIO CIRCUIT WAVEFORMS



PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TRN5716A Audio and Squelch Board Schematic Diagram, Circuit Board Detail, and Troubleshooting Chart
Motorola No. ***PEPS-35824-O***
(Sheet 1 of 2)
2/15/83- UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		transformer, af:
T201	25-84083B02	pri: split winding; total res. 0.5 ohms max. sec: res. 0.8 ohms max. feedback: res. 2 ohms max.
		integrated circuit: (see note)
U201	51-82848M70	type M4870
U202	51-84267A09	type SC6709
		diode: (see note)
VR1	48-82256C38	Zener: 9.1 V; 400 mW
	non-referenced items	
	42-84284B01	RETAINER; 4 req'd.
	3-138162	SCREW, tapping: Phillips rd. hd., 4-40 × 3/8"; 4 req'd. (used for mounting retainers)
	55-84300B01	HANDLE (long)
	55-84300B02	HANDLE (short)
	29-84028H01	TERMINAL, contact; 18 req'd. (long)
	29-84028H02	TERMINAL, contact; 24 req'd. (short)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

MOTOROLA INC.
Communications
Sector

MICOR SENSITRON RECEIVER RF AND I-F BOARD

MODEL TRF1032A
900 MHz

1. INTRODUCTION

This section contains specific theory of operation, maintenance, and troubleshooting information on the receiver rf and i-f deck.

2. RECEIVER RF AND I-F DECK FUNCTIONAL DESCRIPTION

2.1 RF INJECTION STRING

2.1.1 Oscillator (Channel Element)

Channel elements are temperature compensated, crystal controlled oscillators (TCXO), operable over the temperature range of −30° to +60°C (−22° to +140°F). A variable warp capacitor, located in the base of the oscillator, is provided for increased accuracy. Channel elements are factory sealed plug-in modules and should not be field serviced.

2.1.2 Multipliers

The third harmonic of the channel element is selected by a two cell LC tuned circuit. The signal is then multiplied 16 times by two doubler circuits and a double doubler circuit and applied to the two cell preselector of the first mixer.

2.2 RF PRESELECTOR

RF preselector selectivity prevents receiver degradation from mixer image frequency and spurious harmonics. It consists of five low loss, highly selective helical resonant cavities. The bandpass of the preselector is characterized by a flat acceptance bandwidth and a steep skirt response. Carrier signals received at the antenna are routed through the preselector for cavities to the mixer stage to be heterodyned with the injection frequency.

2.3 FIRST MIXER

The first mixer heterodynes the rf signal from the injection string with the carrier signal from the preselector, producing a high i-f of 45 MHz. Frequency relationships are as follows:

$$f_c = 48f_o + 45\text{ MHz}$$

Where: f_c = carrier frequency
f_o = channel element fundamental

2.4 DOUBLE-POLE CRYSTAL FILTER

The double-pole crystal filter accepts the high i-f of 45 MHz and attenuates signals outside the bandwidth. It increases receiver selectivity and couples the high i-f to the second mixer.

2.5 SECOND MIXER

The second mixer uses a field effect transistor with low noise level and high conversion gain to heterodyne the high i-f with a second oscillator frequency, producing a low i-f of 11.7 MHz. Frequency relationships are expressed as follows:

$$45\text{ MHz} = f_o + 11.7\text{ MHz}$$

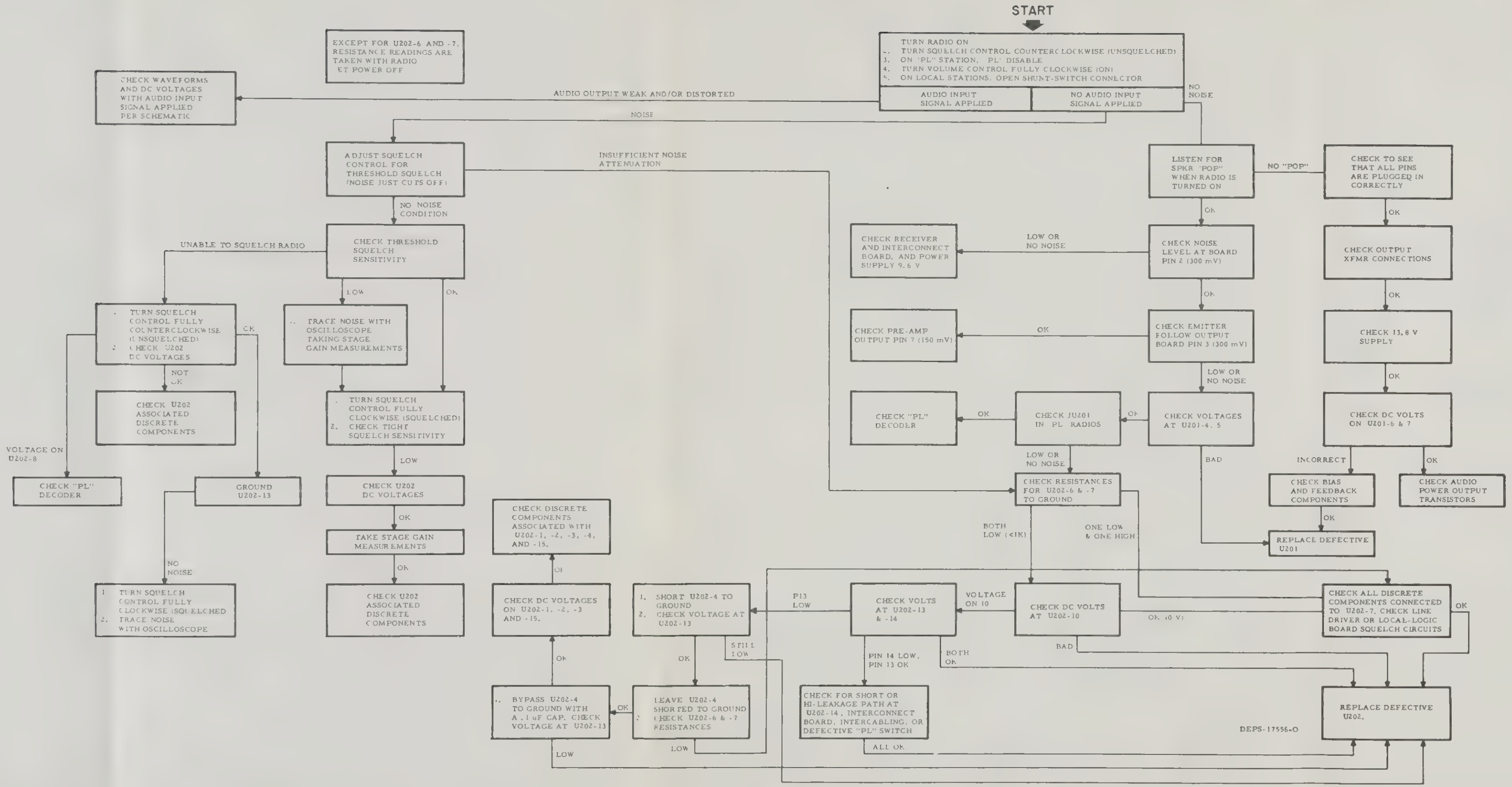
Where f_o = second oscillator frequency

2.6 SECOND OSCILLATOR AND BUFFER

The second oscillator is a crystal controlled, tunable oscillator. It employs a buffer output to prevent load variations from degrading the generated signal and filtering to reduce spurious harmonics.

2.7 FIRST FOUR-POLE CRYSTAL FILTER

This filter and the second four-pole crystal filter are the major factors determining final receiver bandwidth and selectivity.


START
TURN RADIO ON
2. TURN SQUELCH CONTROL COUNTERCLOCKWISE (UNSQUELCHED)
3. ON "PL" STATION, "PL" DISABLE
4. TURN VOLUME CONTROL FULLY CLOCKWISE (ON)
5. ON LOCAL STATIONS, OPEN SHUNT-SWITCH CONNECTOR
AUDIO INPUT SIGNAL APPLIED
NO AUDIO INPUT SIGNAL APPLIED
EXCEPT FOR U202-6 AND -7, RESISTANCE READINGS ARE TAKEN WITH RADIO SET POWER OFF
AUDIO OUTPUT WEAK AND/OR DISTORTED
CHECK WAVEFORMS AND DC VOLTAGES WITH AUDIO INPUT SIGNAL APPLIED PER SCHEMATIC
NOISE
NO NOISE
ADJUST SQUELCH CONTROL FOR THRESHOLD SQUELCH (NOISE JUST CUTS OFF)
INSUFFICIENT NOISE ATTENUATION
NO NOISE CONDITION
CHECK THRESHOLD SQUELCH SENSITIVITY
UNABLE TO SQUELCH RADIO
LOW
OK
1. TURN SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED)
2. CHECK U202 DC VOLTAGES
OK
NOT OK
CHECK U202 ASSOCIATED DISCRETE COMPONENTS
VOLTAGE ON U202-8
CHECK "PL" DECODER
GROUND U202-13
NO NOISE
1. TURN SQUELCH CONTROL FULLY CLOCKWISE (SQUELCHED)
2. TRACE NOISE WITH OSCILLOSCOPE
1. TRACE NOISE WITH OSCILLOSCOPE TAKING STAGE GAIN MEASUREMENTS
1. TURN SQUELCH CONTROL FULLY CLOCKWISE (SQUELCHED)
2. CHECK TIGHT SQUELCH SENSITIVITY
LOW
CHECK U202 DC VOLTAGES
OK
TAKE STAGE GAIN MEASUREMENTS
OK
CHECK U202 ASSOCIATED DISCRETE COMPONENTS
CHECK DISCRETE COMPONENTS ASSOCIATED WITH U202-1, -2, -3, -4, AND -15.
OK
CHECK DC VOLTAGES ON U202-1, -2, -3 AND -15.
OK
1. BYPASS U202-4 TO GROUND WITH A .1 uF CAP. CHECK VOLTAGE AT U202-13
LOW
OK
1. SHORT U202-4 TO GROUND
2. CHECK VOLTAGE AT U202-13
OK
STILL LOW
1. LEAVE U202-4 SHORTED TO GROUND
2. CHECK U202-6 & -7 RESISTANCES
LOW
P13 LOW
CHECK VOLTS AT U202-13 & -14
PIN 14 LOW, PIN 13 OK
BOTH OK
CHECK FOR SHORT OR HI-LEAKAGE PATH AT U202-14, INTERCONNECT BOARD, INTERCABLING, OR DEFECTIVE "PL" SWITCH
ALL OK
VOLTAGE ON 10
CHECK DC VOLTS AT U202-10
OK (0 V)
BAD
LISTEN FOR SPKR "POP" WHEN RADIO IS TURNED ON
NO "POP"
CHECK TO SEE THAT ALL PINS ARE PLUGGED IN CORRECTLY
OK
CHECK OUTPUT XFMR CONNECTIONS
OK
CHECK 13.8 V SUPPLY
OK
CHECK DC VOLTS ON U201-6 & 7
INCORRECT
OK
CHECK BIAS AND FEEDBACK COMPONENTS
CHECK AUDIO POWER OUTPUT TRANSISTORS
OK
REPLACE DEFECTIVE U201
OK
CHECK NOISE LEVEL AT BOARD PIN 2 (300 mV)
LOW OR NO NOISE
CHECK RECEIVER AND INTERCONNECT BOARD, AND POWER SUPPLY 9.6 V
OK
CHECK EMITTER FOLLOW OUTPUT BOARD PIN 3 (300 mV)
OK
CHECK PRE-AMP OUTPUT PIN 7 (150 mV)
LOW OR NO NOISE
CHECK VOLTAGES AT U201-4, 5
BAD
OK
CHECK JU201 IN PL RADIOS
OK
CHECK "PL" DECODER
LOW OR NO NOISE
CHECK RESISTANCES FOR U202-6 & -7 TO GROUND
BOTH LOW (<1K)
ONE LOW & ONE HIGH
CHECK ALL DISCRETE COMPONENTS CONNECTED TO U202-7, CHECK LINE DRIVER OR LOCAL-LOGIC BOARD SQUELCH CIRCUITS
OK
REPLACE DEFECTIVE U202.
DEPS-17556-O

TRN5716A Audio and Squelch Board
Schematic Diagram, Circuit Board Detail,
and Troubleshooting Chart
Motorola No. PEPS-35824-O
(Sheet 2 of 2)
2/15/83- UP

parts list

TRN5716A Audio and Squelch Board PL-8339-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%; 100 V: unless otherwise stated
C201	23-83210A01	25 + 150-10%; 25 V
C202	23-82783B36	39; 10 V
C203	23-84762H10	22 ± 20%; 15 V
C204	8-83813H12	.0047
C205	8-83813H11	0.22; 75 V
C206	8-83813H29	0.33; 50 V
C207	23-82783B24	15; 25 V
C208	8-83813H01	.0068
C209	8-83813H26	.0056 ± 5%; 50 V
C210	8-83813H16	.022
C211	8-83813H11	0.22; 75 V
C212	21-848236	650 pF ± 5%; 500 V
C213	8-83813H11	0.22; 75 V
C214	23-84081B03	75 + 150-10%; 15 V
C215	8-83813H11	0.22; 75 V
C216	21-82187B20	1000 pF
C217	21-82187B43	.0039; 200 V
C218	8-83813H11	0.22; 75 V
C219		NOT USED
C220	21-83406D46	56 pF ± 5%; 500 V; N150
C221	23-84081B01	50 + 100-10%; 25 V
C222	23-83210A08	100 + 150-10%; 25 V
C223, 224	21-82372C04	.05 + 80-20%, 25 V
C225	8-82905G16	.033
C226	21-82187B31	1500 pF ± 10%; 100 V
C227	8-83813H07	0.15; 75 V
C228	21-84494B22	750 pF ± 5%
C229	23-84762H07	4.7 ± 20%; 10 V
C230	21-84426B06	100 pF ± 5%; 500 V
C231		NOT USED
C232	21-82133G03	100 pF ± 5%; 500 V; N750
C233	21-863296	2500 pF ± 2%
C234	8-83813H31	.01; 100 V
C235	8-83813H11	0.22; 75 V
C236	23-84762H08	3.9 ± 20%; 15 V
C238	21-82372C01	0.1 + 80-20%; 25 V
C239	21-83596E10	220 pF ± 20%; 500 V
C240	21-832501	.01 + 60-40%; 250 V
C241, 242	21-83596E10	220 pF ± 20%; 500 V
C243	21-832501	.01 + 60-40%; 250 V
C244		NOT USED
C245, 246		NOT USED
C247	21-832501	.01 + 60-40%; 250 V
C249	21-83596E10	220 pF ± 20%; 500 V
C251	21-84426B11	470 pF ± 5%; 500 V
C252	8-82905G25	.0033
C253	8-82905G15	.015
C254	21-874354	5100 pF ± 5%
		diode: (see note)
CR201	48-83654H01	silicon
		connector, plug:
P201		consists of contact pins mounted on circuit board
		transistor: (see note)
Q203	48-869642	NPN; type M9642
		resistor, fixed: ± 5%; 1/4 W: unless otherwise stated
R201, 202	6-11009C61	3.3k
R203	18-83083G24	variable: 25k ± 30%
R204	6-11009C05	15
R205	6-11009C49	1k
R206	6-11009C93	68k
R207	6-11009C99	120k
R208	6-11009C73	10k
R209	6-11009C17	47
R210	6-11009C51	1.2k
R211	6-11009C63	3.9k
R212	6-11009C49	1k
R213	6-11009C97	100k
R214	6-11009C89	47k
R215	6-11009C49	1k
R216	6-11009C57	2.2k
R217	6-11009C01	10
R218, 219	6-11009C09	22
R220, 221	6-11009C71	8.2k
R222	6-11009C95	82k
R224	6-11009C45	680
R225, 226	6-11009C17	47
R227, 228	6-11009C61	3.3k
R229 thru 231		NOT USED
R232	6-11009C85	33k
R233		NOT USED
R234	6-11009C65	4.7k
R235	6-11009D04	180k
R236	6-11009C89	47k
R237	6-11009C75	12k
R240		NOT USED
R241	6-11009C53	1.5k
		transformer, af:
T201	25-84083B02	pri: split winding; total res. 0.5 ohms max sec: res 0.8 ohms max feedback: res. 2 ohms max
		integrated circuit: (see note)
U201	51-82848M70	type M4870
U202	51-84267A09	type SC6709
		diode: (see note)
VR1	48-82256C38	Zener 9.1 V; 400 mW
		non-referenced items
	42-84284B01	RETAINER; 4 req'd
	3-138162	SCREW, tapping: Phillips rd hd, 4-40 × 3/8"; 4 req'd. (used for mounting retainers)
	55-84300B01	HANDLE (long)
	55-84300B02	HANDLE (short)
	29-84028H01	TERMINAL, contact; 18 req'd. (long)
	29-84028H02	TERMINAL, contact; 24 req'd (short)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

MOTOROLA INC.
Communications
Sector

MICOR SENSITRON RECEIVER RF AND I-F BOARD

MODEL TRF1032A
900 MHz

1. INTRODUCTION

This section contains specific theory of operation, maintenance, and troubleshooting information on the receiver rf and i-f deck.

2. RECEIVER RF AND I-F DECK FUNCTIONAL DESCRIPTION

2.1 RF INJECTION STRING

2.1.1 Oscillator (Channel Element)

Channel elements are temperature compensated, crystal controlled oscillators (TCXO), operable over the temperature range of −30° to +60°C (−22° to +140°F). A variable warp capacitor, located in the base of the oscillator, is provided for increased accuracy. Channel elements are factory sealed plug-in modules and should not be field serviced.

2.1.2 Multipliers

The third harmonic of the channel element is selected by a two cell LC tuned circuit. The signal is then multiplied 16 times by two doubler circuits and a double doubler circuit and applied to the two cell preselector of the first mixer.

2.2 RF PRESELECTOR

RF preselector selectivity prevents receiver degradation from mixer image frequency and spurious harmonics. It consists of five low loss, highly selective helical resonant cavities. The bandpass of the preselector is characterized by a flat acceptance bandwidth and a steep skirt response. Carrier signals received at the antenna are routed through the preselector for cavities to the mixer stage to be heterodyned with the injection frequency.

2.3 FIRST MIXER

The first mixer heterodynes the rf signal from the injection string with the carrier signal from the preselector, producing a high i-f of 45 MHz. Frequency relationships are as follows:

$$f_c = 48f_o + 45\text{ MHz}$$

Where: f_c = carrier frequency
f_o = channel element fundamental

2.4 DOUBLE-POLE CRYSTAL FILTER

The double-pole crystal filter accepts the high i-f of 45 MHz and attenuates signals outside the bandwidth. It increases receiver selectivity and couples the high i-f to the second mixer.

2.5 SECOND MIXER

The second mixer uses a field effect transistor with low noise level and high conversion gain to heterodyne the high i-f with a second oscillator frequency, producing a low i-f of 11.7 MHz. Frequency relationships are expressed as follows:

$$45\text{ MHz} = f_o + 11.7\text{ MHz}$$

Where f_o = second oscillator frequency

2.6 SECOND OSCILLATOR AND BUFFER

The second oscillator is a crystal controlled, tunable oscillator. It employs a buffer output to prevent load variations from degrading the generated signal and filtering to reduce spurious harmonics.

2.7 FIRST FOUR-POLE CRYSTAL FILTER

This filter and the second four-pole crystal filter are the major factors determining final receiver bandwidth and selectivity.

The first four-pole crystal filter consists of two monolithic crystals and associated impedance matching circuitry. The output of the mixer is coupled to the input of the filter by an adjustable matching network.

Each crystal produces mechanical vibrations at the crystal input when the electrical i-f signal is applied. Due to the inherent piezoelectric property of quartz crystals, these vibrations are propagated throughout the crystal and reconverted to electrical signals at the output electrodes. The high "Q" of the crystals creates a narrow bandpass resulting in excellent off-channel signal rejection.

2.8 FIRST I-F AMPLIFIER

The first i-f amplifier couples signals between the first and second four-pole crystal filters and provides approximately 70 dB gain. The integrated circuit (U601) contains three differential amplifier stages that are internally voltage regulated and temperature compensated. Isolation between the three stages is provided internally.

2.9 SECOND FOUR-POLE CRYSTAL FILTER

The second four-pole crystal filter establishes final receiver selectivity and operates identically to the first four-pole crystal filter previously described. The filter signal is applied to the second i-f amplifier.

2.10 SECOND I-F AMPLIFIER AND LIMITER

The second i-f amplifier and limiter consists of integrated circuit (U602) and with associated discrete components performs amplification and limiting functions.

Four differential amplifiers with internal voltage regulation and temperature compensation are employed. The first two differential amplifiers provide approximately 55 dB gain. The second stage output provides metering and is applied to the third stage. The third stage, along with the fourth stage, becomes overdriven to provide excellent symmetrical limiting characteristics. Full limiting occurs regardless of signal strength.

The limited output of the second i-f amplifier is applied to the discriminator. Since amplitude has now been made constant, the discriminator, which normally would respond to both amplitude and frequency variations produces true frequency demodulation.

3. MAINTENANCE

3.1 INTRODUCTION

This section provides maintenance procedures for the receiver rf and i-f board. These procedures consist of tests which include metering measurements and testing and troubleshooting procedures that includes integrated circuit checks.

NOTE

The receiver rf and i-f board must be installed in a receiver chassis for testing to provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stages of the receiver.

3.2 PERFORMANCE TESTS

3.2.1 General

Use the following tests to determine if the receiver rf and i-f board is operating properly. If testing produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart (diagram DEPS-35320).

3.2.2 No-Signal Meter Reading Test

A failure in any part of the rf and i-f board will usually result in improper meter readings at one or more test positions. Perform checks at meter position 1 through 5 and compare the results with values shown in Table 1.

Table 1. Minimum Receiver RF & I-F Meter Readings (No Input Signal Applied)

Selector Switch Position	Reading (Micro-Amps)	Circuit Metered
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4+, 4−	0 ±2	Discriminator Output
5	10	Second I-F Amplifier & Limiter

3.2.2.1 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver chassis for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the receiver as follows:

- Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.
- Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:

- Set the function switch to the RCVR position.
- Set the meter reversing switch to the OFF position.
- Set the adapter cable SENS switch to the 100 mV position. If the adapter cable has no SENS switch, the unit operates at 100 mV all of the time.
- Set the adapter cable reference switch to position A or position B.

Step 6. Refer to the readings in Table 1. Set the test set selector switch to the positions called for in the table and observe the test set meter. Notice that the meter readings given in the table are minimums.

3.2.2.2 Input Voltages

3.2.2.2.1 If there are no test set indications at one or more of the metered points, check the dc input voltages to the receiver rf and i-f circuit board.

P904-9	A + continuous (+13.8 V dc with reference to chassis)
P904-11	9.6 V dc continuous (with reference to chassis) (±0.5 V)
P904-8, 6	9.6 V dc continuous (with reference to chassis) (±0.5 V)

3.2.2.2.2 If test set indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

3.2.2.3 Using Built-In Receiver Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Plug the receiver service kit into the station.

NOTE

The receiver service kit will not operate unless the TKN6759A Cable Kit has been installed in the receiver.

It is not necessary to turn the metering POWER switch on. The switch should only be in the "on" position when the METER SELECTOR switch is set on position 6.

Step 5. Refer to the meter reading table in paragraph 3.2.2. Set the meter selector switch to the positions called for in the table and observe the meter. Notice that the meter readings given in the table are minimums.

3.2.2.4 20 dB Quieting Sensitivity Test

This performance test may be used after repair and alignment to assure that the receiver meets all specifications before it is returned to service. The receiver shield must be in place while performing this test.

- Using an AC Voltmeter and Portable Test Set

Step 1. Perform Steps 1 thru 5 in paragraph 3.2.2.1.

Step 2. Connect an ac voltmeter across pins 1 and 18 of the audio control module.

Step 3. (PL receivers only.) Disable PL, using the switch on the PL module.

Step 4. Set the receiver squelch control fully counterclockwise (unsquelched).

Step 5. Adjust the LINE LEVEL control so the ac voltmeter reads 565 mV ac.

Step 6. Set the signal generator controls as follows:

- Set up the signal generator to produce a cw or unmodulated signal.
- Set the generator output level to maximum.
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until test set meter position 4 reads exactly zero.

Step 7. Slowly decrease the signal generator output level until the ac voltmeter reads 56.5 mV ac (20 dB down from 565 mV ac). Switch to a lower voltmeter scale if necessary.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 8. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less.

Step 9. Readjust the LINE LEVEL control as described in the Maintenance section of the manual.

3.2.2.5 Using Built-In Receiver Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver. Turn metering on.

Step 4. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. *Private-Line* stations must also be PL disabled.

Step 5. Set meter selector switch to POS 6 and the speaker switch to the "off" POS. Adjust the LINE LEVEL control for 50 uA as indicated on the meter.

Step 6. Connect an rf signal generator to the receiver input connector.

Step 7. Set the signal generator controls as follows:

- Set up the signal generator to produce a cw or unmodulated signal.
- Set the generator output level to maximum.
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until meter position 4 reads exactly zero.

Step 8. Slowly decrease the signal generator output level until METER POS 6 reads 5 uA.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 9. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less.

Step 10. Readjust the LINE LEVEL control as described in the Maintenance section of the manual.

3.3 FIRST MIXER REPLACEMENT PROCEDURE

3.3.1 General

3.3.1.1 Extreme care must be exercised in removing the mixer substrate. It is recommended that complete troubleshooting be performed to assure that the mixer is faulty before attempting replacement. No attempt should be made to repair individual substrate components, Rather, *the mixer should be replaced as an assembly*.

3.3.1.2 Two types of soldering irons are required to remove and replace the mixer. A chisel tipped iron of 150 watt rating is needed for connections to the rf deck. A small iron of 50 watt rating is required for substrate connections.

3.3.2 Replacement Procedure

Step 1. Remove the receiver rf and i-f board from the chassis.

Step 2. Unplug the mixer output cable from the rf and i-f board and remove the screws holding the cable lugs to the rf deck.

Step 3. Remove the four hex-Phillips screws which hold the mixer cavity shield.

Step 4. Using the large iron, unsolder the ground straps from the rf deck, adding solder as necessary to insure proper heat transfer.

Step 5. Carefully unsolder the two heavy gauge wire connections leading to pads at the top edge of the mixer substrate.

CAUTION

Prolonged heat or excessive strain at these connections may result in permanent damage to the substrate and associated components.

When both leads are free, bend the leads slightly to facilitate easy removal of the substrate.

Step 6. Lift the substrate VERTICALLY out of the rf deck.

Step 7. Press the nylon guides onto the edges of the replacement mixer substrate and carefully slide the unit into the rf deck.

Step 8. Using a large, well tinned iron, solder the ground straps to the rf deck. Remove excess solder to allow the cover to fit flush over the mixer cavity.

Step 9. Bend the heavy leads to conform to the pads on the substrate. The leads must be formed so that no strain is placed on the substrate when the leads are soldered in place. Use the minimum heat necessary to insure a good solder connection.

Step 10. Replace mixer cavity cover.

3.4 DOUBLE DOUBLER REPLACEMENT PROCEDURES

3.4.1 Assembly Replacement Procedure

Step 1. Disconnect the input coaxial cable (phono connector to printed circuit board) and the output cable (coaxial cable from the injection filter).

Step 2. Disconnect the 9.6 volt supply line (orange) at the printed circuit board.

Step 3. Remove the screws which fasten the input coaxial cable to the rf deck.

Step 4. Remove the three screws which fasten the quadrupler housing to the rf deck.

Step 5. Replace the new double doubler assembly in the reverse order of the above procedure.

3.4.2 Transistor Replacement Procedure

Using a 50 watt soldering iron and silver solder (silver content 2%), perform transistor replacement as follows.

Step 1. Carefully unsolder L201, L203, and R201 at the transistor pads and bend the components away from the transistor.

Step 2. Unsolder and remove the transistor.

Step 3. Remove excess solder from the substrate solder pads.

Step 4. Place the new transistor on the substrate pads. While holding the transistor in place with a tweezers, solder the emitter lead first and then the remaining leads. Be sure the transistor leads are positioned in the center of their respective substrate pads.

Step 5. Reposition L201, L203, and R201 and resolder their leads.

Step 6. Perform double doubler testing to insure unit is properly functioning.

3.5 TROUBLESHOOTING

3.5.1 Visual Inspection

3.5.1.1 The first step in the troubleshooting procedure should be a thorough visual inspection of the receiver and, in particular, the receiver rf and i-f board. Corrosion and burned or damaged components are usually easily seen and may be the cause of a symptom of the receiver malfunction. Loose circuit board mounting screws or a loose or improperly installed receiver shield are other easily found problems that can cause a considerable degradation in receiver performance.

3.5.1.2 After the obvious problems have been corrected, repeat the receiver rf and i-f board performance tests. If the tests still produce unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart. The troubleshooting chart provides a systematic procedure for isolation of the defective stage and component.

3.5.1.3 As much information as possible has been included on the troubleshooting chart. However, you may have to refer occasionally to the receiver rf and i-f schematic diagram and circuit board detail. Detailed procedures regarding integrated circuits, troubleshooting, receiver gain measurements, and crystal dip tests follow in the text of this section of the manual.

3.5.2 Alignment as a Troubleshooting Technique

Low test set readings, improper discriminator output, and otherwise abnormal performance are very often corrected by realignment. Therefore, alignment should be one of the first troubleshooting steps performed for these symptoms.

3.5.3 Troubleshooting Integrated Circuits

3.5.3.1 Integrated circuits (ICs) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

3.5.3.2 The ICs on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in Table 2.

Table 2.
Nominal Receiver Integrated Circuit DC Voltages
(All readings are in volts dc,
measured with respect to chassis)

Pin No.	U601 Voltage	U602 Voltage
1	GND	2.8
2	GND	GND
3	2.9	2.9
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.9	2.9
9	2.9	2.9
10	GND	GND

NOTE: All voltages may vary ±10% from nominal readings shown.

3.5.4 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every filter crystal has a good conductive path to ground. An ohmmeter test should indicate less than 1 ohm between the crystal case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure. Complete receiver rf and i-f alignment. Leave alignment test equipment connected to perform this check.

Step 2. Refer to receiver gain measurements in Table 3, the rf and i-f schematic diagram, and the rf and i-f circuit board detail.

NOTE

Receiver rf input voltages given in Table 3 are those at the receiver input connector. If a pad or other attenuator is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

Examples:

6 dB loss means V out of the pad = 1/2 V into the pad.

20 dB loss means V out of the pad = 1/10 V into the pad.

Step 3. Set the signal generator output frequency to the receiver channel frequency ("0" reading on meter 4). Adjust the signal generator output to provide the required receiver input voltage for a particular test point as listed in the table. Then, using an rf voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. When using a high impedance rf probe (see Table of Recommended Test Equipment), the measured voltage at every test point should be within ±6 dB of the value given in Table 3.

Table 3. Receiver Gain Measurements

Test Point (See rf & i-f circuit board detail)	Receiver Input Voltage (preset)	Test Point Voltage (mV) ±6 dB	Remarks
L	50 mV	180	
M	50 mV	250	
N	50 mV	600	
O	50 mV	575	
P	50 mV	550	
Q	50 mV	500	
R	50 mV	250	U601
S	50 mV	800	saturated
T	20 uV	400	output
U	20 uV	375	
V	20 uV	350	
W	20 uV	300	U602
X	20 uV	75	saturated
Y	0	1000	output

Step 4. A high or low test point voltage measurement *may* indicate that the crystal at or ahead of the test point is defective. However, it may also indicate that an associated circuit component is defective. The extremely high-Q crystals used in *Micor* radios are very sensitive to associated circuit components. For example, if L601 is defective, it might appear that Y601 is bad. To isolate the defective component, perform the crystal dip tests described in the following procedure.

3.5.5 Crystal Dip Test

3.5.5.1 A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

3.5.5.2 The monolithic crystals used in *Micor* receivers are made up of two separate resonators on a single quartz blank. Each crystal has a pair of characteristic operating frequencies. One way to find the characteristic frequencies of each crystal is to short the crystal output to chassis ground, then monitor the crystal input voltage with an rf voltmeter while varying the signal generator frequency across the bandpass of the receiver. Low voltage points will occur at each of the crystal characteristic frequencies.

3.5.5.3 Figures 1 and 2 are plots of typical rf voltmeter readings obtained while testing good crystals. Note that the horizontal scales are calibrated in frequency, with f_o the channel frequency of the receiver. The vertical scales represent *relative* rf voltmeter readings. The bottom line is zero and the top line is maximum. Notice that each plot has a sharp minimum point above f_o and another below f_o. The table of crystal dip frequencies at the end of this section lists the frequencies at which these dip points should appear. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective.

Step 1. Leave the test equipment set up as was done for the receiver gain measurements.

Step 2. Set the signal generator to f_o, the receiver channel frequency ("0" on meter 4). Adjust the generator output control for at least 50 mV *at the receiver input connector*.

Step 3. Refer to the crystal dip frequencies in Table 4. To test a particular crystal, find it in the table, ground the indicated test point, and connect an rf voltmeter between the monitored test point and a nearby chassis ground point.

Step 4. Starting at f_o, slowly increase the signal generator frequency while watching for a dip in the rf voltmeter reading. This dip should be sharp, so increase the signal generator frequency very slowly and watch the rf voltmeter closely. When the dip is found, write down the frequency counter reading.

Table 4. Crystal Dip Frequencies

Crystal	Test Point Grounded	Test Point Monitored	+ Frequency Dip (kHz) ±2.5 kHz	– Frequency Dip (kHz) ±2.5 kHz
Y601	O	N	4.5	9.0
Y602	Q	P	4.0	10.0
Y603	U	T	4.5	9.0
Y604	W	V	4.0	10.0

Step 5. Return the signal generator to f_o. Then watch the rf voltmeter while *slowly decreasing* the signal generator frequency. When the dip is found, write down the frequency counter reading.

Step 6. Compare your test results with the frequencies and tolerances listed in the table for the crystal you have tested. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective. Continue with this procedure to isolate the bad component.

Step 7. FOR TEST PURPOSES ONLY, exchange the suspected crystal with another from the receiver. Be sure you note the polarity of the crystal when you make the change. Repeat the receiver gain measurement and crystal dip test on the suspected crystal in the new location. If the suspected crystal tests bad again, consider it defective and replace it. If the crystal tests good, look for defective associated components at the original crystal location.

Step 8. When the tests are completed, be sure *all* jumpers connected during the test are removed and that any *moved crystals are returned to their original locations*. Refer to the parts list and circuit board detail for correct part location. Note crystal polarity when replacing crystals.

3.5.6 Double Doubler Troubleshooting

Disconnect the input coaxial cable (phono connector to printed circuit board). Test the second doubler output. If the second doubler is operating properly, reconnect the double doubler input coaxial cable to the 2nd doubler. Disconnect the double doubler output cable. Using a 50 ohm probe, rated for at least 1000 MHz, test the double doubler output voltage. A minimum reading of 70.7 millivolts should be obtained. If the minimum reading is not obtained, check the dc voltages on the schematic.

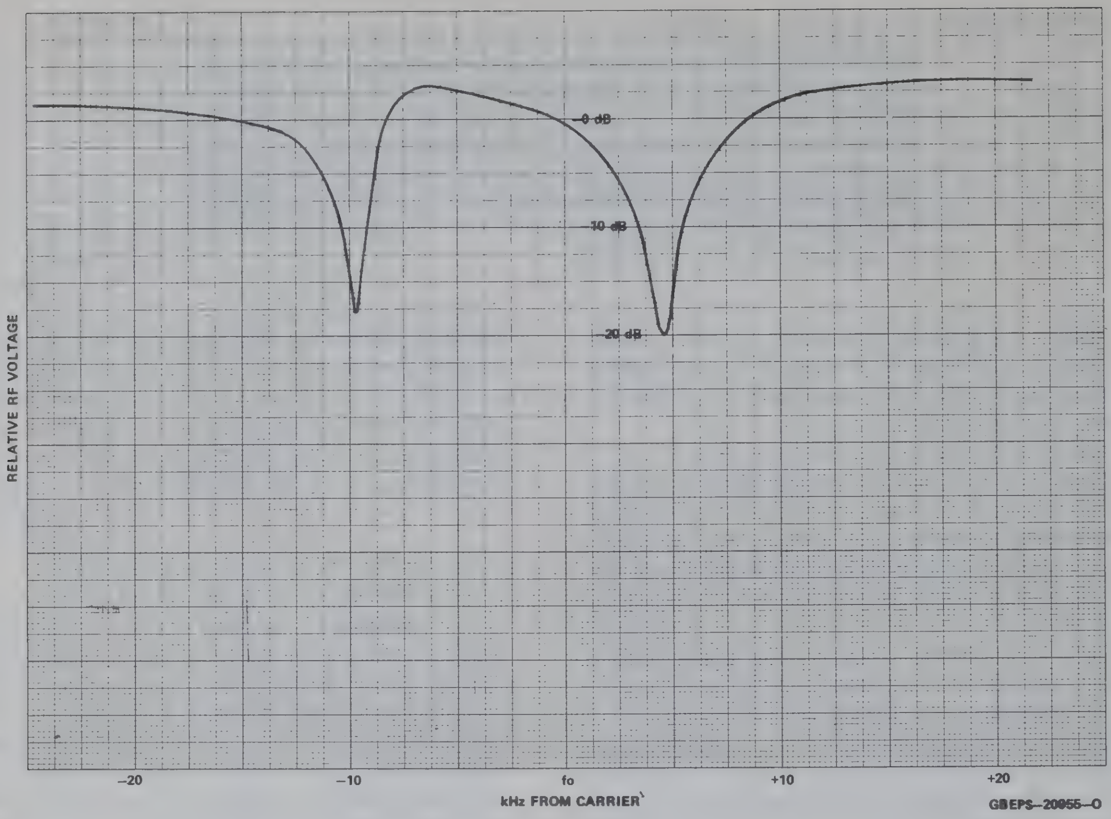


Figure 1.   Typical Plot of a Known Good Crystal in Position Y601 or Y603

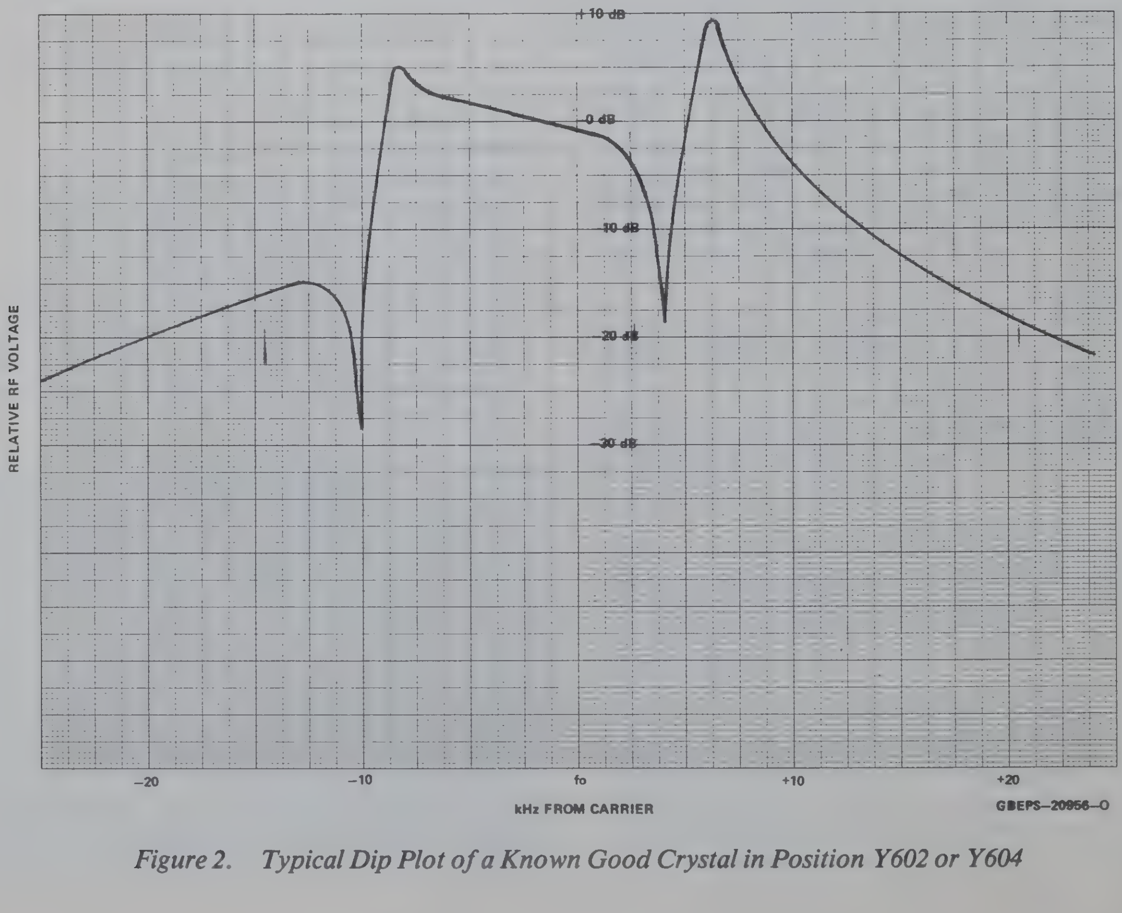


Figure 2.   Typical Dip Plot of a Known Good Crystal in Position Y602 or Y604

1. CHECK SUPPLY VOLTAGE ON SECOND MIXER.
2. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
3. PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES.

CHECK DC VOLTAGES ON 2ND DOUBLER ACCORDING TO SCHEMATIC DIAGRAM.

INTEGRATED CIRCUIT

E IN VOLTS DC,
SPECT TO CHASSIS)

E	U602 VOLTAGE
	2.8
	GND
	2.8
	6.6
	9.3
	7.2
	6.4
	2.8
	2.8
	GND

AY VARY +10% FROM
GE SHOWN.

TRF1032A RF and I-F Board
Troubleshooting Chart
Motorola No. DEPS-35320-O
12/1/82- UP

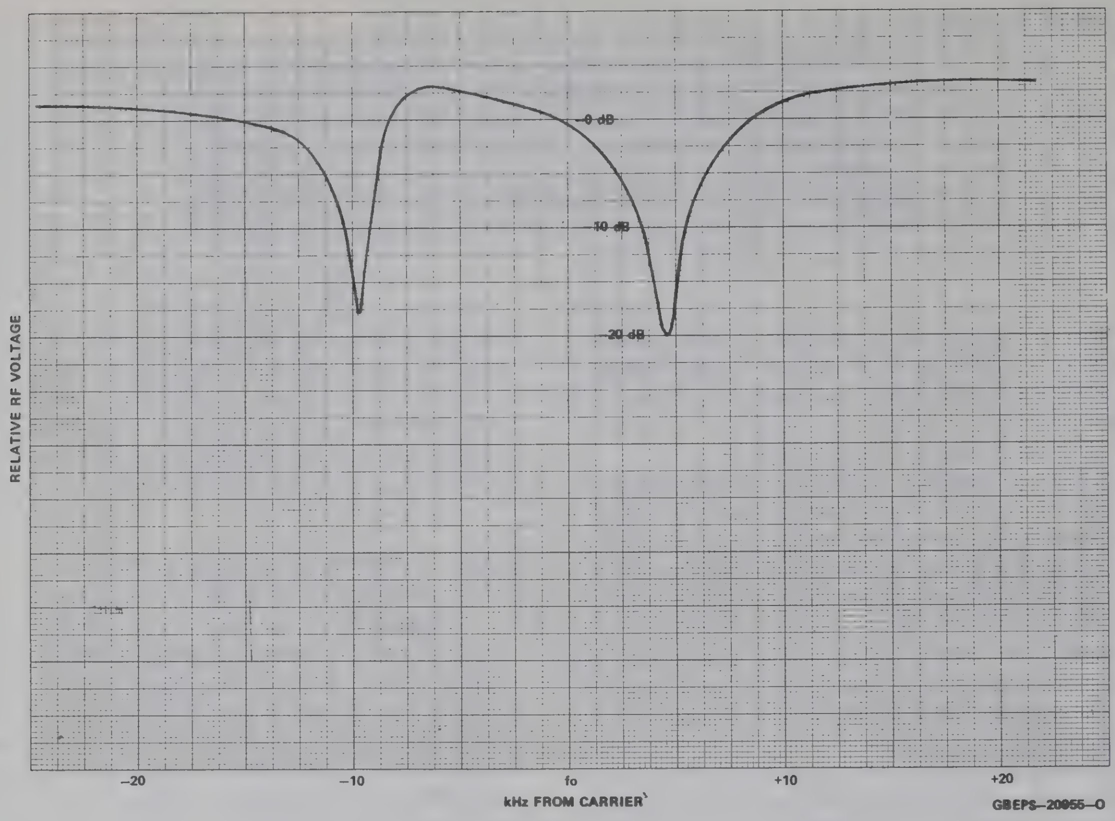


Figure 1. Typical Plot of a Known Good Crystal in Position Y601 or Y603

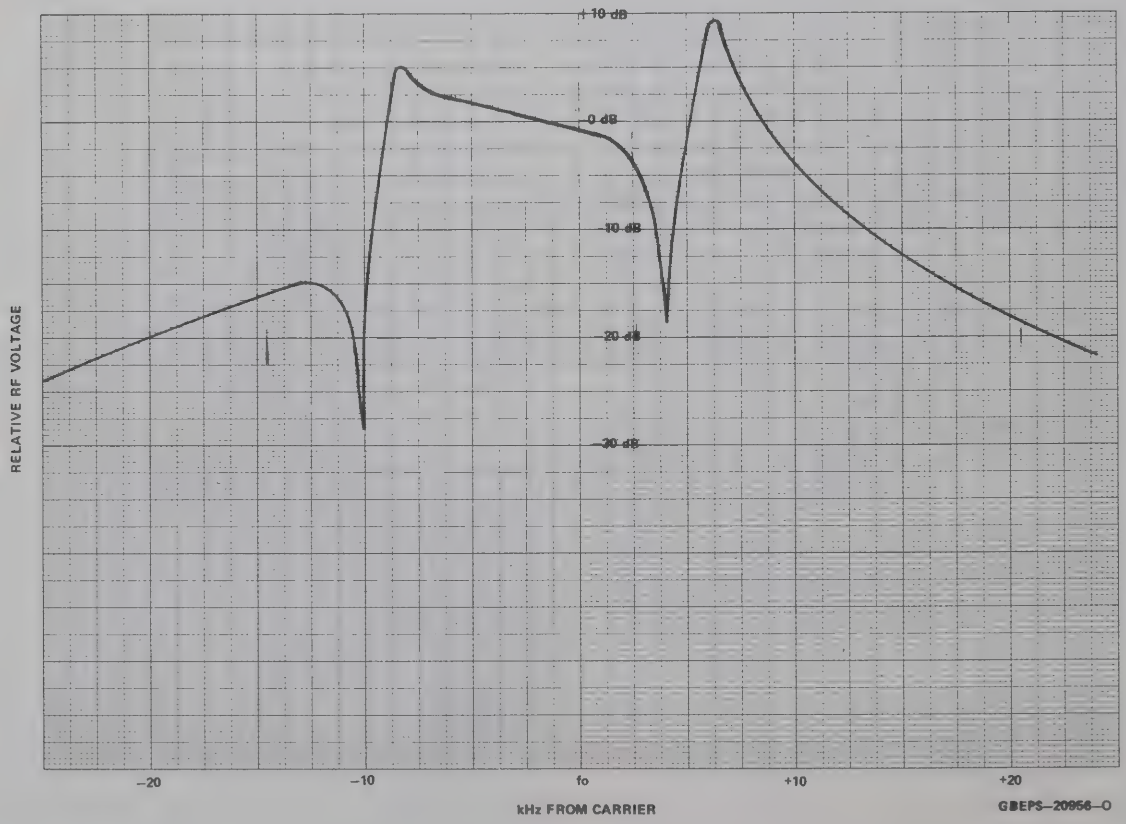
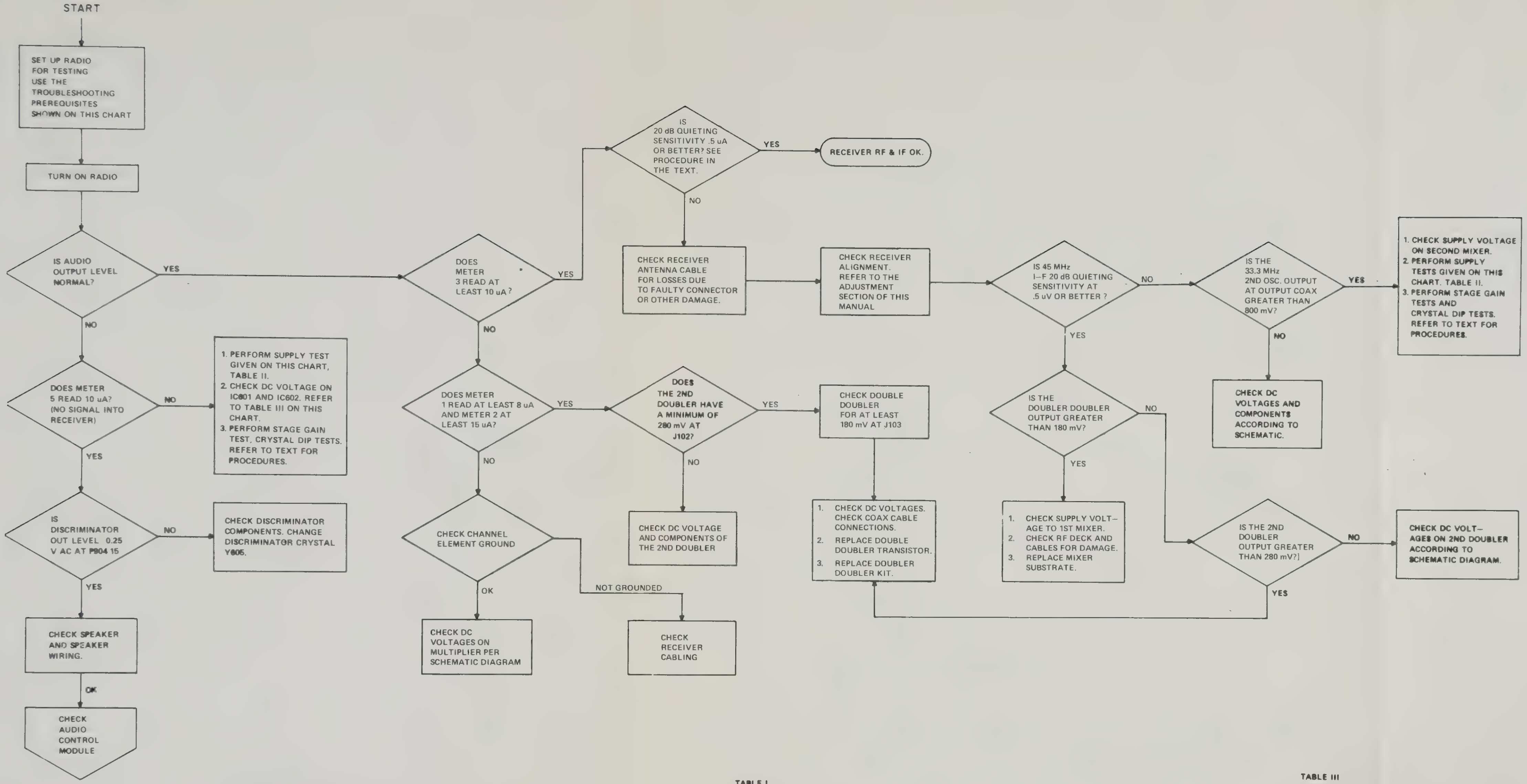


Figure 2. Typical Dip Plot of a Known Good Crystal in Position Y602 or Y604


START
SET UP RADIO FOR TESTING USE THE TROUBLESHOOTING PREREQUISITES SHOWN ON THIS CHART
TURN ON RADIO
IS AUDIO OUTPUT LEVEL NORMAL?
YES
NO
DOES METER 5 READ 10 uA? (NO SIGNAL INTO RECEIVER)
NO
1. PERFORM SUPPLY TEST GIVEN ON THIS CHART, TABLE II.
2. CHECK DC VOLTAGE ON IC601 AND IC602. REFER TO TABLE III ON THIS CHART.
3. PERFORM STAGE GAIN TEST, CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES.
YES
IS DISCRIMINATOR OUT LEVEL 0.25 V AC AT P904 15
NO
CHECK DISCRIMINATOR COMPONENTS. CHANGE DISCRIMINATOR CRYSTAL Y605.
YES
CHECK SPEAKER AND SPEAKER WIRING.
OK
CHECK AUDIO CONTROL MODULE
DOES METER 3 READ AT LEAST 10 uA ?
YES
NO
DOES METER 1 READ AT LEAST 8 uA AND METER 2 AT LEAST 15 uA?
YES
NO
CHECK CHANNEL ELEMENT GROUND
OK
NOT GROUNDED
CHECK DC VOLTAGES ON MULTIPLIER PER SCHEMATIC DIAGRAM
CHECK RECEIVER CABLING
IS 20 dB QUIETING SENSITIVITY .5 uA OR BETTER? SEE PROCEDURE IN THE TEXT.
YES
RECEIVER RF & IF OK.
NO
CHECK RECEIVER ANTENNA CABLE FOR LOSSES DUE TO FAULTY CONNECTOR OR OTHER DAMAGE.
CHECK RECEIVER ALIGNMENT. REFER TO THE ADJUSTMENT SECTION OF THIS MANUAL
DOES THE 2ND DOUBLER HAVE A MINIMUM OF 280 mV AT J102?
YES
NO
CHECK DC VOLTAGE AND COMPONENTS OF THE 2ND DOUBLER
CHECK DOUBLE DOUBLER FOR AT LEAST 180 mV AT J103
1. CHECK DC VOLTAGES. CHECK COAX CABLE CONNECTIONS.
2. REPLACE DOUBLE DOUBLER TRANSISTOR.
3. REPLACE DOUBLER DOUBLER KIT.
IS 45 MHz I–F 20 dB QUIETING SENSITIVITY AT .5 uV OR BETTER ?
NO
YES
IS THE DOUBLER DOUBLER OUTPUT GREATER THAN 180 mV?
NO
YES
1. CHECK SUPPLY VOLT–AGE TO 1ST MIXER.
2. CHECK RF DECK AND CABLES FOR DAMAGE.
3. REPLACE MIXER SUBSTRATE.
IS THE 33.3 MHz 2ND OSC. OUTPUT AT OUTPUT COAX GREATER THAN 800 mV?
YES
NO
1. CHECK SUPPLY VOLTAGE ON SECOND MIXER.
2. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
3. PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES.
CHECK DC VOLTAGES AND COMPONENTS ACCORDING TO SCHEMATIC.
IS THE 2ND DOUBLER OUTPUT GREATER THAN 280 mV?]
NO
YES
CHECK DC VOLT–AGES ON 2ND DOUBLER ACCORDING TO SCHEMATIC DIAGRAM.

TROUBLESHOOTING PREREQUISITES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS:
   - A. CONNECT THE ADAPTER CABLE 20–PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   - B. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
3. SET PORTABLE TEST SET SWITCHES AS FOLLOWS:
   - A. FUNCTION SWITCH TO THE RCVR POSITION.
   - B. METER REVERSING SWITCH TO OFF POSITION.
   - C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   - D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   - E. D. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
4. ON "PRIVATE–LINE" RADIOS, DISABLE THE PL MODULE.
5. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
6. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.
7. HIGH RF FREQUENCY MEASUREMENTS SHOULD BE MADE WITH AN ACCURATE METER SUCH AS THE MOTOROLA S1339A (SEE EQUIPMENT LIST).

TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO–AMPS)	CIRCUIT METERED
1	8	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	10	SECOND DOUBLER OUTPUT
4	0 ± 2	DISCRIMINATOR OUTPUT
5	10	SECOND I–F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

TEST POINT	DESCRIPTION
P904–9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904–11	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)
P904–8,6	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

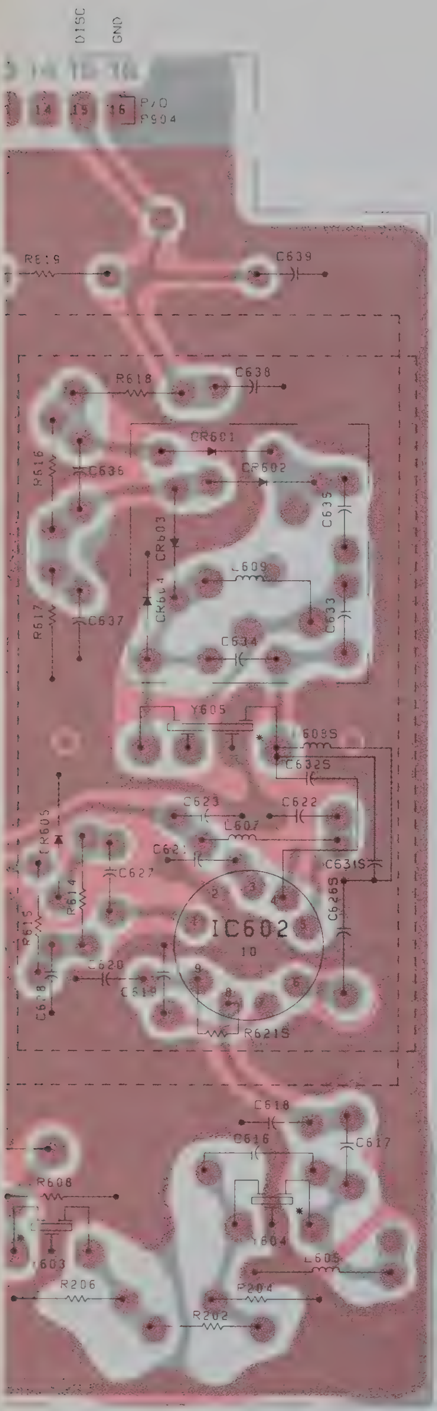
TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

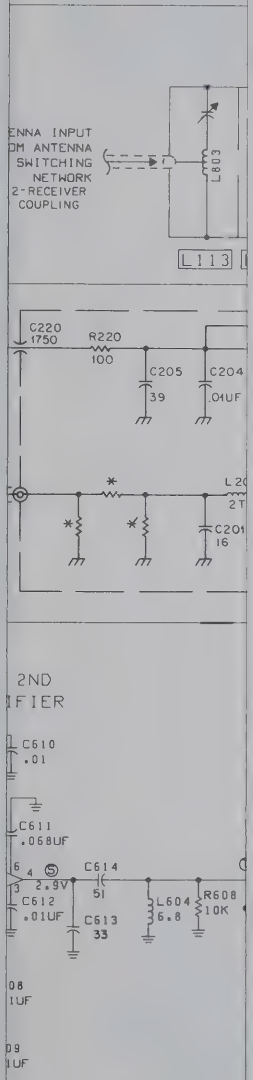
NOTE: ALL VOLTAGES MAY VARY +10% FROM NOMINAL READINGS SHOWN.

TRF1032A RF and I-F Board
Troubleshooting Chart
Motorola No. DEPS-35320-O
12/1/82- UP

RECEIVER RF & I—F BOARD

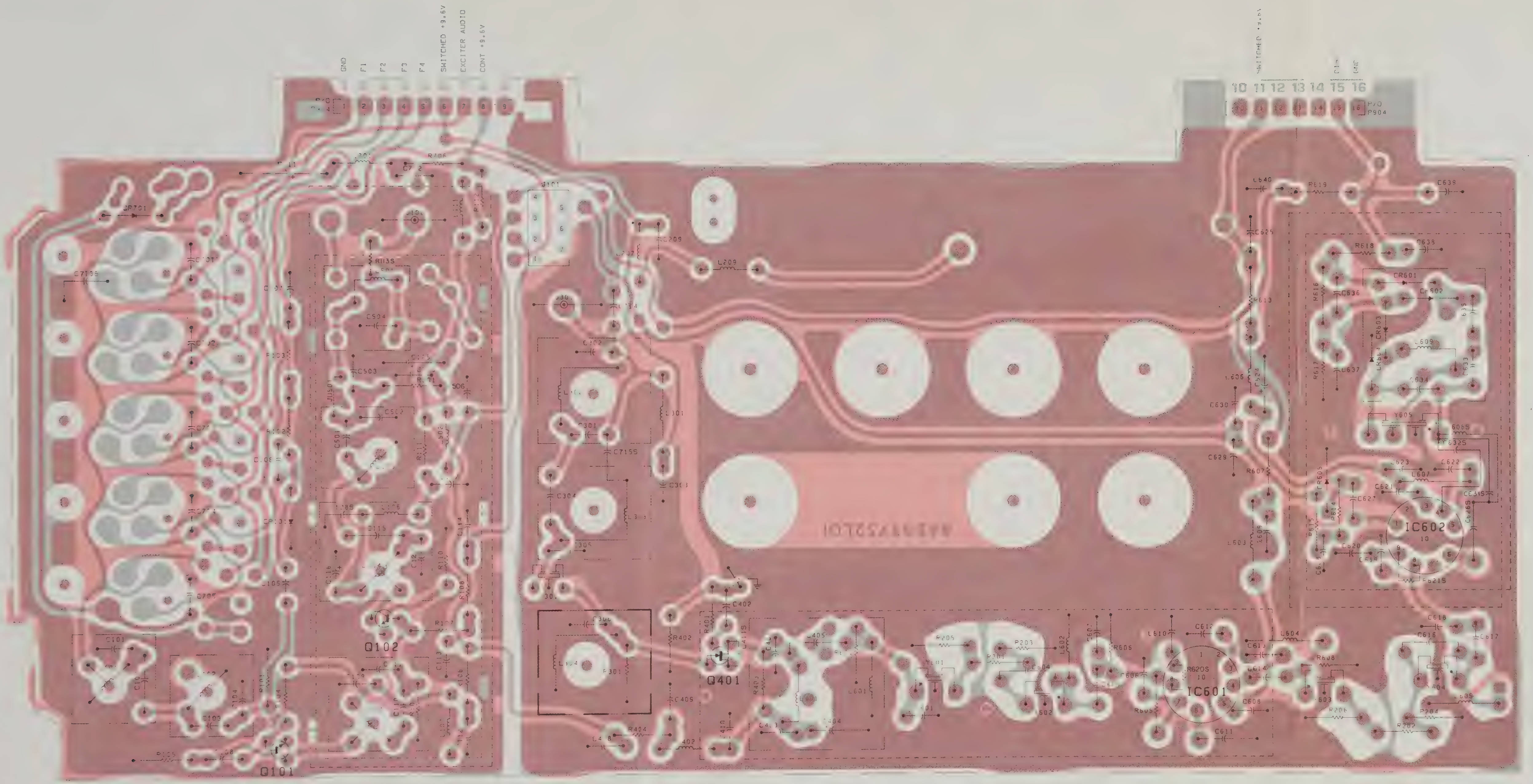

DISC
GND
14
15
16
P/O
P904
R619
C639
R618
C638
CR601
CR602
R616
C636
C635
CR603
L609
CR604
R617
C637
C633
C634
Y605
L608S
C632S
C623
C622
L607
CR605
C621
C627
C631S
R614
IC602
C626S
R615
C620
C619
C628
R621S
C618
C616
C617
R608
Y604
Y603
L605
R206
R204
R202

COMPONENT SIDE ● BD-EEPS-24370-0
SOLDER SIDE ● BD-EEPS-24371-0
OL-EEPS-24372-A


ENNA INPUT
DM ANTENNA
SWITCHING
NETWORK
2-RECEIVER
COUPLING
L803
L113
C220
1750
R220
100
C205
39
C204
.01UF
L20
2T
C201
16
2ND
IFIER
C610
.01
C611
.068UF
C614
51
2.9V
C612
.01UF
C613
33
L604
6.8
R608
10K
08
1UF
09
1UF

PARTS LISTS SHOWN ON BACK OF THIS DIAGRAM

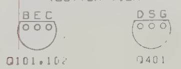
TRF1032A RF and I-F Board
Schematic Diagram and Circuit Board Detail
Motorola No. ***PEPS-35631-O***
(Sheet 2 of 2)
12/1/82- UP


GND
F1
F2
F3
F4
SWITCHED +9.6V
EXCITER AUDIO
CONT +9.6V
1
2
3
4
5
6
7
8
9
SWITCHED +9.6V
10
11
12
13
14
15
16
P/O
P904
R706
Q101
Q102
Q401
IC601
IC602
CR601
L209
L101
L605
L604
L606
C639
C640
C611
C612
R402
R404
R607
R608
R613
R617
R618

TRF1032A RF and I-F Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-35631-O
(Sheet 1 of 2)
12/1/82-UP

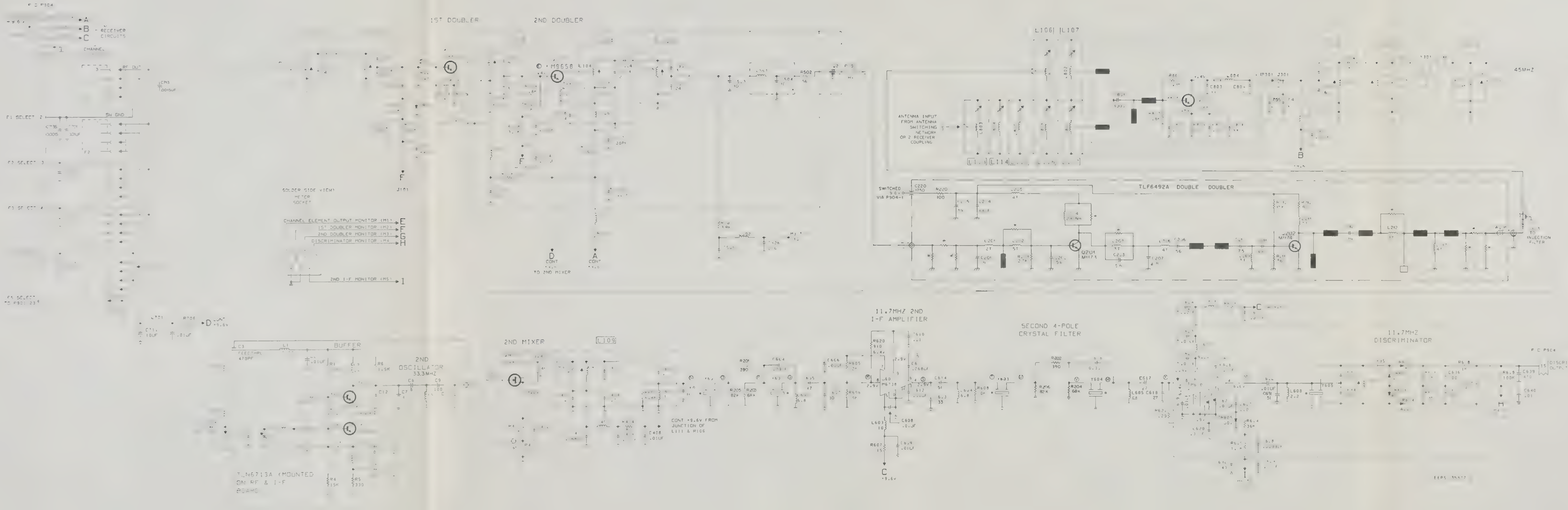
SHOWN FROM SOLDER SIDE

TRANSISTOR LEAD DETAILS
(BOTTOM VIEW)


B E C
Q101,102
D S G
Q401

— — SHIELD ON COMPONENT SIDE
– – – – – SHIELD ON SOLDER SIDE
PARTS ENDING IN 'S' ARE ON SOLDER SIDE
*–INDICATES CRYSTAL POLARITY

COMPONENT SIDE 🟥 BD-EEPS-24370-O
SOLDER SIDE ● BD-EEPS-24371-O
OL-EEPS-24372-A


1ST DOUBLER
2ND DOUBLER
M9658
L106 L107
ANTENNA INPUT FROM ANTENNA SWITCHING NETWORK OR 2 RECEIVER COUPLING
L803
L114
C803
C804
L804
P301 J301
45MHZ
SWITCHED 9.6V VIA P904-1
C220 1750
R220 100
TLF6492A DOUBLE DOUBLER
Q201 M1171
U202 M1174
TO INJECTION FILTER
SOLDER SIDE VIEW METER SOCKET
J101
CHANNEL ELEMENT OUTPUT MONITOR (M1) E
1ST DOUBLER MONITOR (M2) F
2ND DOUBLER MONITOR (M3) G
DISCRIMINATOR MONITOR (M4) H
2ND I-F MONITOR (M5) I
D CONT TO 2ND MIXER
A CONT
BUFFER
2ND OSCILLATOR 33.3MHZ
TLN6713A (MOUNTED ON RF & I-F BOARD)
2ND MIXER
L109
CONT +9.6V FROM JUNCTION OF L111 & R104
11.7MHZ 2ND I-F AMPLIFIER
SECOND 4-POLE CRYSTAL FILTER
11.7MHZ DISCRIMINATOR
P.C. P904
DISCRIMINATOR OUTPUT
C

RECEIVER RF & I-F NOTES

101 FREQUENCY CALCULATION

$f_c = 48 f_o + 45$ MHZ
$f_o = \frac{f_c - 45 \text{ MHZ}}{48}$

WHERE f_c = CARRIER FREQUENCY
f_o = CHANNEL ELEMENT FREQUENCY
45 MHZ = 1ST MIXER OUTPUT FREQUENCY (1ST I-F)
48 = CHANNEL ELEMENT HARMONIC
11.7 MHZ = 2ND MIXER OUTPUT FREQUENCY (2ND I-F)

102 DASHED LINES REPRESENT SHIELDING

103 INDEX DOT ON CRYSTAL CAN INDICATES PHYSICAL ORIENTATION REQUIRED

104 UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS

105 FOR ACCURATE MEASUREMENT RF VOLTAGES TAKEN WITH MOTOROLA RF MILLIVOLTMETER AND RF PROBE. QUADRUPLER OUTPUT WITH 50 OHM BNC TIP PROBE

106 UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND

107 DC VOLTAGE IS FUNCTION OF SIGNAL LEVEL

108 THE TWO-RECEIVER COUPLER MOUNTS IN THE RECEIVER SECTION OF THE UNIFIED CHASSIS. THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH RECEIVERS

109 THE 2 RECEIVER COUPLER IS USED IN BASE STATION APPLICATIONS ONLY

TABLE 1
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES. ALL READINGS ARE IN VOLTS DC MEASURED WITH RESPECT TO CHASSIS

[illegible]	VOLTAGE	[illegible]
[illegible]	GND	[illegible]
[illegible]	GND	GND
[illegible]	2.8	2.8
[illegible]	6.6	6.6
[illegible]	9.3	9.3
[illegible]	7.2	7.2
[illegible]	6.4	6.4
[illegible]	2.8	2.8
[illegible]	2.8	2.8
10	GND	GND

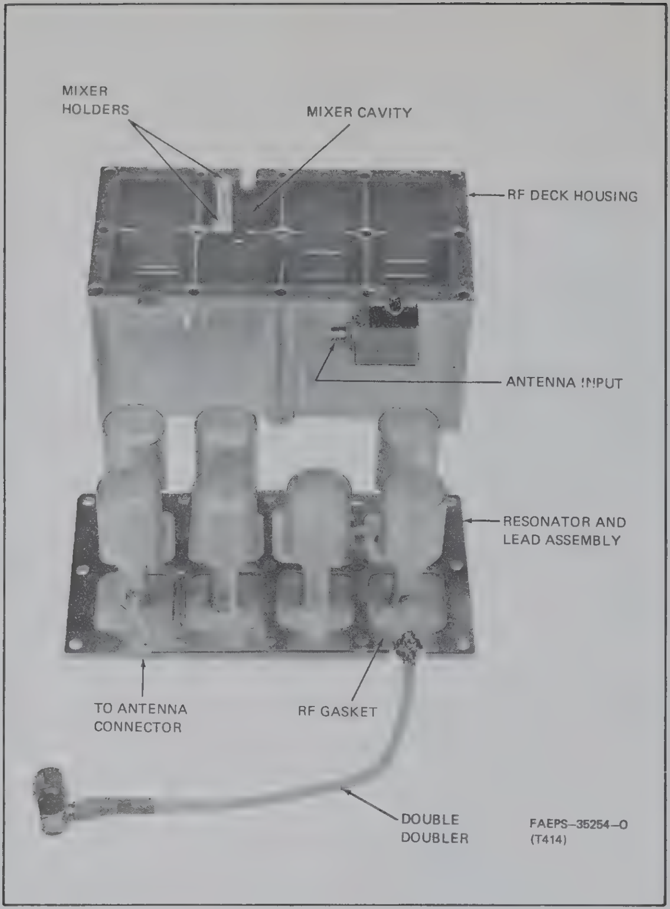
NOTE: ALL VOLTAGES MAY VARY FROM NOMINAL READINGS SHOWN.

LEGEND

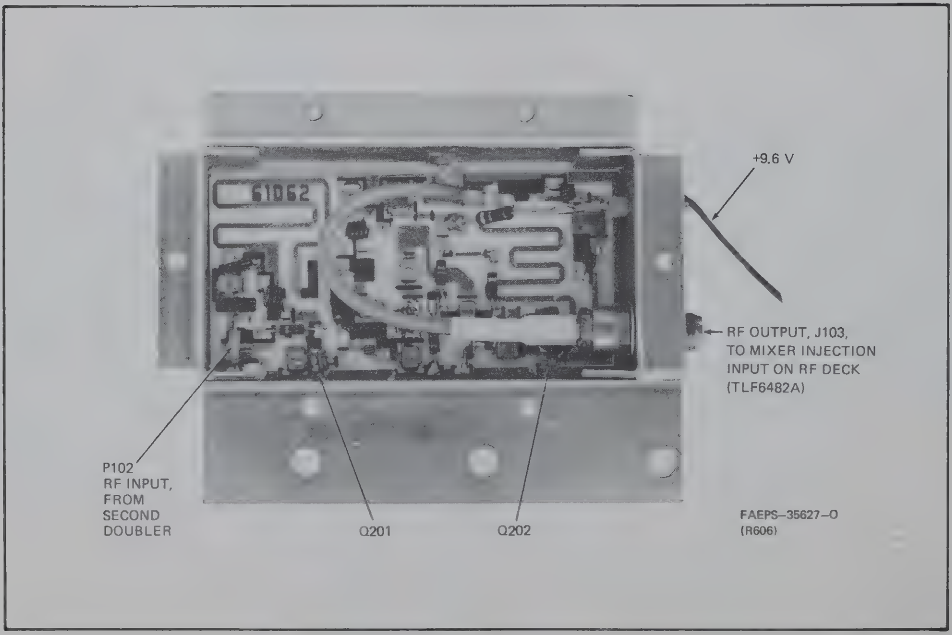
⏚	CHASSIS GND	*	SCREENED RESISTOR
⏚	SUBSTRATE GND	---	SHIELDED CABLE OR ENCLOSURE
□	AREA CAPACITOR	■	TRANSMISSION LINE

PARTS LISTS SHOWN ON BACK OF THIS DIAGRAM

TRF1032A RF and I-F Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-35631-O
(Sheet 2 of 2)
12/1/82- UP


MIXER
HOLDERS
MIXER CAVITY
RF DECK HOUSING
ANTENNA INPUT
RESONATOR AND
LEAD ASSEMBLY
TO ANTENNA
CONNECTOR
RF GASKET
DOUBLE
DOUBLER
FAEPS–35254–O
(T414)

RF DECK


+9.6 V
RF OUTPUT, J103,
TO MIXER INJECTION
INPUT ON RF DECK
(TLF6482A)
P102
RF INPUT,
FROM
SECOND
DOUBLER
Q201
Q202
FAEPS–35627–O
(R606)

DOUBLE DOUBLER

TECHNICAL CHARACTERISTICS

ncy Range		928-960 MHz
pacing		25 kHz
lation Acceptance		± 8 kHz minimum
		Channel element maintains receiver frequency within ± 0.0002% of reference frequency from − 30 °C to + 60 °C ambient temperature (+ 25 °C reference).
edance		50 ohms
	20 dB Quieting	0.5 uV
	EIA Sinad	0.35 uV
(EIA Sinad)		− 80 dB @ ± 25 kHz
Intermodulation		− 75 dB
nd Image Rejection		100 dB minimum
nsitivity Squelch (adjustable)		0.25 uV or less at threshold
ed Squelch		0.25 uV or less
ded Squelch		0.25 uV or less

RECEIVER RF & I—F BOARD

TRF1032A RF and I-F Board
Alignment Procedure
Motorola No. ***PEPS-35633-O***
12/1/82-UP

parts list

TRF6112C Receiver RF and I-F Board PL-8215-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 5%; 500 V: unless otherwise stated
C101	21-82133G74	24; N150
C102	21-82450B29	0.51
C103	21-84493B44	33
C104	21-82610C44	100
C105	21-857336	2 ± .2
C106, 107	21-82428B59	.01 uF + 80-20%; 200 V
C108	21-82355B26	10 ± .25
C109	21-82187B11	.0015 uF ± 10%; 100 V
C110	21-838912	8 ± .25
C111	21-82610C14	30
C112	21-82187B08	220 ± 10%
C113, 114	21-82428B59	.01 uF + 80%20%; 200 V
C115	21-82450B35	0.2 ± 10%
C116	21-82187B08	220 ± 10%
C117	21-831125	100 ± 10%, 300 V
C124	21-857336	2
C125	23-84762H04	2.2 uF ± 20%
C128	21-840365	24
C209	21-82187B20	1000 ± 10%; 100 V
C301	21-83406D37	27
C302	21-84534B05	180
C303	21-82428B59	.01 uF + 80-20%; 200 V
C304	21-82450B08	1.2
C305	21-82133G46	24
C306	21-82133G62	22
C401	21-82610C89	110, 200 V
C402	21-82187B31	1500 ± 10%; 200 V
C403	21-82610C03	47; 200 V
C404	23-84762H04	2.2 uF ± 20%; 25 V
C405	21-82450B11	3; 500 V
C408, 409	21-82428B59	.01 uF + 80-20%, 200 V
C410	8-82905G04	.068 uF ± 10%; 50 V
C411	21-840848	6 pF ± .5 pF
C501	21-82610C94	3 ± .1
C502	21-840365	24
C503, C504	21-83406D89	10
C505	21-82428B59	.01
C506	21-82187B08	220
C601	21-851845	11; NPO
C604	21-82450B07	0.39
C605	21-83406D44	47 ± 0.5%, N080
C606	21-82426B59	.01 uF + 80-20%, 200 V
C607	21-82610C14	30 pF ± 5 pF, N150
C608	21-82428B59	.01 uF + 80-20%, 200 V
C609, 610	21-82428B59	.01 uF + 80-20%, 200 V
C611	8-83813H05	.068 uF ± 10%, 100 V
C612	21-82428B59	.01 uF ± 10%, 200 V
C613	21-82355B09	33 ± 0.5%, NPO
C614	21-82610C29	51 ± 0.5%, N150
C616	21-82450B01	0.30 ± 0.5%
C617, 618	21-83406D37	27 ± 0.5%, N150
C619, 620	21-82428B59	.01 uF + 80-20%, 200 V
C621, 622, 623, 624	23-84762H04	2.2 uF ± 20%, 25 V
C625	21-82428B59	.01 uF + 80-20%, 200 V
C626	8-83813H06	10 uF ± 10%, 100 V
C627	21-82187B08	220
C628	21-82428B57	.0033 uF ± 10%, 200 V
C629	21-82428B59	.01 uF + 80-20%; 200 V
C630	21-84493B24	40
C631	21-82610C07	51; 200 V
C632	21-861443	.01 uF + 100-20%; 75 V
C633, 634, 635, 636, 637	21-83798B01	100; 200 V
C638, 639	21-82187B39	470 ± 10%
C640	21-82428B59	.01 uF + 80-20%, 200 V
C701 thru 705	21-82428B59	.01 uF + 80-20%; 200 V
C711	23-84762H03	10 uF ± 10%, 20 V
C712	21-82428B59	.01 uF + 80-20%, 200 V
C713	21-82187B11	.0015 uF ± 10%, 100 V
C714	21-00865054	13; N330
C715	21-840848	6 pF ± 0.5 pF
		diode: (see note)
CR101	48-82139G01	germanium
CR601 thru 604	48-84616A01	hot carrier
CR605	48-82139G01	germanium
CR701	48-82392B03	silicon
		connector, receptacle
J101	9-84207B01	female, 7 contact
J102, J301	9-84231B02	female, single contact
		coil, rf:
L101	24-84972A15	8-1/2 turns, BRN
L102	24-84972A16	6-1/2 turns, RED
L103	24-84972A17	8-1/2 turns, ORG
L104	24-83857G07	12 turns, multiplier
L105	24-83857G05	14-1/4 turns, multiplier
L106, 107	24-83961B01	3 turns; BRN
L111	24-83961B01	3 turns, BRN
L207	24-82723H07	choke, 10 uH
L209	24-82723H05	choke, 0.41 uH; YEL
L301	24-82723H07	choke, 10 uH
L302 thru 304	24-84113B01	7-1/2 turns, BRN
L401	24-84258B05	GRN
L402	24-82723H07	choke, 10 uH
L501	24-83884G01	choke, molded
L502	24-83961B01	3 turns; BRN
L601	24-82549D25	choke, 10 uH
L602	24-84250D02	choke, 6.8 uH
L603	24-82723H07	choke, 10 uH
L604, 605	24-84250D02	choke; 6.8 uH
L606, 607	24-82723H07	choke, 10 uH
L608	24-84250D03	choke, 2.2 uH
L609	24-83879G04	20 turns, YEL
L701	24-83961B01	3 turns; BRN
		transistor: (see note)
Q101, 102	48-869658	NPN, M9658
Q401	48-869651	field-effect
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R101	6-124C55	1.8k
R102	6-124A69	6.8k ± 5%
R103	6-124A55	1.8k ± 5%
R104	6-124C83	27k
R105	6-124A13	33 ± 5%
R106	6-124C29	150
R107	6-124C81	22k
R108	6-124C61	3.3k
R109	6-124C55	1.8k
R110	6-124A09	22 ± 5%
R111	6-124C29	150
R112	6-124C01	10
R113	6-185B64	56; 1/8 W
R201, 202	6-124A39	390
R203, 204	6-124A93	68k
R205, 206	6-124A95	82k
R301	6-124A63	3.9k
R401	6-124C49	1k
R402	6-124A32	220 ± 5%
R403	6-124A81	22k ± 5%
R404	6-124C31	180
R501	6-124A63	3.9k ± 5%
R502	6-185B64	56; 1/8 W
R601	6-124A69	6.8k ± 5%
R605	6-124A75	12k ± 5%
R606	6-124A73	10k ± 5%
R607	6-124C05	15
R608	6-124A73	10k ± 5%
R613	6-124C01	10
R614	6-124A86	36k ± 5%
R615	6-124C53	1.5k
R616, 617	6-124A76	13k
R618	6-124C49	1k
R619	6-124A97	100k
R620	6-124A48	910 ± 5%
R621	6-124A33	220 ± 5%
R706	6-124C01	10
		integrated cicuit: (see note)
U601	51-84267A38	type M6738
U602	51-84267A07	type M6707
		crystal: (see note)
Y301	48-84577K01	45.0 MHz
Y601	48-84755E08	11.7 MHz
Y602 thru 604	48-84755E07	11.7 MHz
Y605	48-84754E01	11.7 MHz (discriminator)
		non-referenced items
	3-134212	SCREW 4-40 x 5/16"; 10 req'd.
	3-138162	SCREW, tapping; 4-40 x 3/8"; 8 req'd.
	3-138891	SCREW, tapping; 6-32 x 7/16"; 6 req'd.
	4-49854	WASHER, spacer, 2 req'd.
	29-855943	PIN, terminal, plated; 20 req'd.
	29-10134A29	LUG, terminal
	29-84028H01	TERMINAL, male 16 req d
	43-868700	BUSHING, threaded, 8 req d.
	55-84300B02	HANDLE; 2.12"
	55-84300B03	HANDLE, 1.83"

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers

TLN5891A Receiver Shield Kit PL-8217-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-139495	SCREW, tapping; 6-32 x 5/16"; 5 used
	26-82640L01	SHIELD

TRF6482A RF Deck PL-8216-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 20%; 500 V: unless otherwise stated
C801	21-84547A01	1000-20%; 50 V
C802	21-84547A05	10000 pF
C803	21-84736E12	39 pF ± 5%; 500 V
C804	21-84873H17	56 pF ± 10%; 50 V
C805	21-84547A05	10000 pF
C806	21-84736E12	39 pF ± 5%; 500 V
		connector, receptacle:
J102	8-82547L02	female; single contact
		coil, rf:
L801 thru 807	1D83010K03	resonator and lead assy.
L808	76-83960B01	ferrite bead
L809	24-82723H05	choke; 0.41 uH
		connector, plug:
P301	28-84282D01	male; single-contact
P102	28-87317C01	male; single contact
		transistor: (see note)
Q801	48-869870	NPN; M9870
R801, 802, 803		cannot be replaced
		mechanical parts
	3-134268	SCREW, tapping: 4-40 x 7/16"; 4 req'd.
	15-84630E01	COVER, connector (J801)
	42-83032K01	HOLDER; 2 req'd.
	64-83018K02	PLATE, cover
	29-5227	LUG, soldering; #6; 2 req'd.
	15-83014K01	HOUSING, rf deck
	2-84773E03	NUT, tension; 7 req'd.
	3-84997K01	SLUG TUNING; 7 req'd.
	32-82101L02	GASKET
	3-136138	SCREW, tapping: 6-32 x 3/8"; 11 req'd.
	32-82555M01	GASEKET, lead

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN6713A 2nd Oscillator Kit PL-4217-O

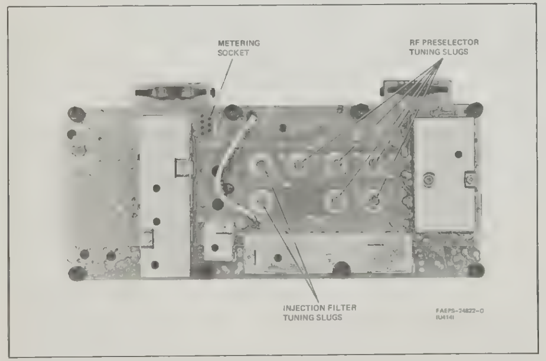
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 5%: unless otherwise stated
C1	20-82399D04	variable; 5.5-18 pF
C2	21-82428B59	.01 uF + 80-20%; 200 V
C3	21-821474	470 pF ± 20%; 500 V
C4	21-82355B09	33 pF; 500 V
C5	21-831125	100 pF ± 10%; 300 V
C6	21-82187B14	.001 uF ± 10%; 100 V
C7	21-84395B01	40 pF; 500 V
C8	21-840848	6 pF ± 0.5 pF; 500 V
C9	21-82610C44	100 pF ± 10%; 100 V
C10	21-82880E33	80 pF; 800 V
C11	21-82187B14	.001 uF ± 10%; 100 V
C12	21-840848	6 pF ± 0.5 pF; 500 V
C13	21-82204B22	5 pF; 250 V
		coil, rf:
L1	24-82723H04	choke; 0.29 uH
L2	24-82723H05	choke; 0.41 uH
L3	24-890687	choke, 2.0 uH
L4	24-82723H01	choke; 1.2 uH
L5	24-82723H05	choke; 0.41 uH
		transistor: (see note)
Q1, 2	48-869494	NPN; type M9494
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R1, 2	6-124C77	15k
R3	6-124C51	1.2k
R4	6-124C77	15k
R5	6-124A37	330 ± 5%
R6	6-124A53	1.5k ± 5%
		crystal:
Y1	48-83860F09	33.3 MHz
		mechanical parts
	3-139012	SCREW, 4-40 x 1/4"
	4-474216	WASHER, 2 req'd.
	15-82304L01	COVER
	43-83066F05	BUSHING; 0.250" length; 2 req'd.
	43-83066F06	BUSHING, 0.170" length
	43-83617D01	BUSHING, round
	14-84602K02	INSULATOR, crystal; 2 req'd.
	26-82303L01	SHIELD
	43-82555L01	SPACER, threaded (oscillator shield)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

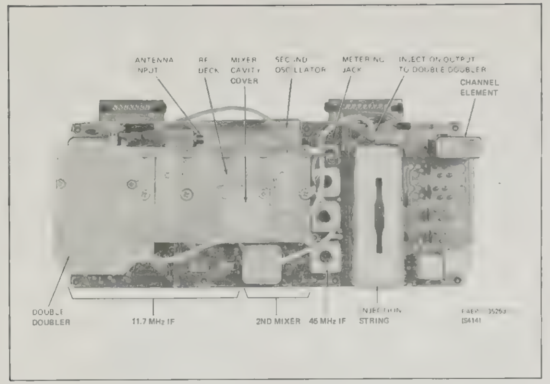
TLF6492A Double Doubler Board (Rcvr.) PL-8244-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF; 50 V: unless otherwise stated
C201	21-84736E08	16 ± 5%
C202	21-84736E18	5.6 ± 0.5 pF
C203	21-84736E18	5.6 ± 0.25 pF
C204	21-84547A05	.01 uF ± 20%
C205	21-84736E12	39 ± 5%
C206	21-84736E31	56 ± 10%
C207	21-84736E17	6.8 ± 0.5 pF
C210	21-84736E29	7.5 ± 0.25 pF
C211	21-84736E21	100 ± 5%
C212	21-84736E12	39 ± 5%
C220	91-87511C01	RFI, 1750
		connector, receptacle:
J103	9-87318C04	female, panel mounting
		coil, rf:
L201	24-84311M22	2-turns
L202	24-84311M39	5-turns
L203	24-84331M44	3-turns
L204	24-82723H40	290 nH
L205, 206	24-84331M10	4-turns
L210	24-84331M44	3-turns
L211	24-84331M47	7-turns
L212	24-84331M22	2-turns
L213	24-84331M45	4-turns
		connector, plug:
P102	28-84282D01	phono, male
		transistor: (see note)
Q201	48-84411L73	NPN; M1173
Q202	48-84411L74	NPN; type M1174
		resistor, fixed: ± 5%; 1/8 W:
R201	6-185B84	2.7 kohms ± 10%
R210	6-185A77	15k
R211	6-185A49	560
R212	6-185A23	82
R220	6-185A25	100
		cable assembly:
W1	1-80791B63	consists of: ref. item P102
	30-83794C01	CABLE, coaxial; 11" used
	29-5227	LUG, solder; 2 used
W201	1-80764D86	consists of: ref. item J103
	30-859004	CABLE, coaxial; 3.5" used
		mechanical parts
	29-83208M01	LUG, solder
	3-134169	SCREW, tapping, 4-40 x 1/4", 6 used
	15-82575L01	HOUSING, quadrupler
	30-10151A17	WIRE, flat
	64-82576L01	PLATE, cover
	39-10184A24	CONTACT, receptacle

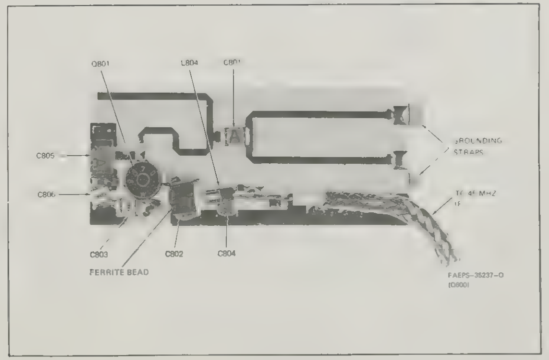
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



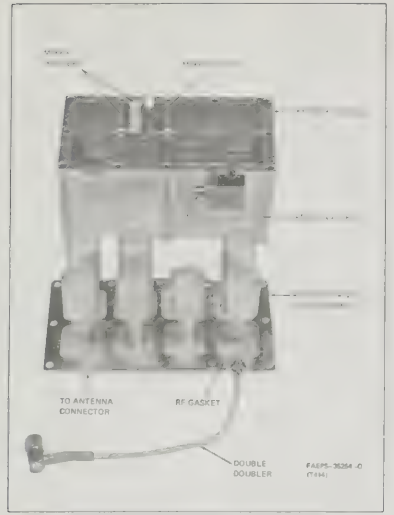
RECEIVER REAR VIEW



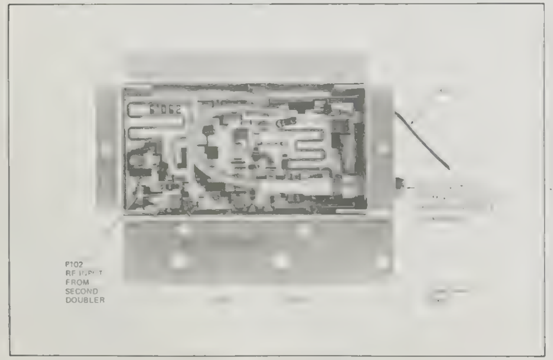
RECEIVER FRONT VIEW



MIXER BOARD



RF DECK



DOUBLE DOUBLER

RECEIVER ALIGNMENT PROCEDURE

A. FREQUENCY CALCULATIONS

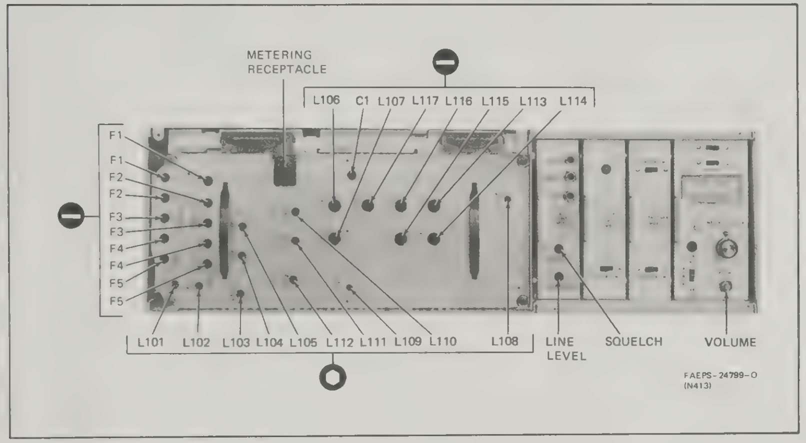
Where:

f_o = channel element frequency

f_c = carrier frequency

$$f_o = \frac{f_c - 45\text{ MHz}}{48}$$

B. RECEIVER ADJUSTMENT LOCATIONS



FAEPS-24799-O
(N413)

C. MINIMUM RECEIVER METER READINGS
(NO INPUT SIGNAL APPLIED)

Test Set Selector Switch Position	Reading (uA)	Circuit Metered
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4+, 4−	0 ±2	Discriminator Output
5	10	Second I-F Amplifier and Limiter

D. RECEIVER ALIGNMENT

Step	Adjust	Meter Position	Stage and Procedure
1	L101, L102, L103, L104, L105		MULTIPLIER COILS — Adjust the cores of L101, L102, L103, and L105 to the end of the coil form flush with the printed circuit board. Adjust the core of L104 to the end of the coil form away from the printed circuit board.
2	L110, L111, L112		FIRST I-F COILS — Adjust the cores of L110, L111, and L112 to the end of the coil form flush with the printed circuit board.
3	L106, L107, L113, L114, L115, L116, L117		PRESELECTOR AND INJECTION FILTER — Adjust the slugs at L106, L107, and L113 through L117 away from the rf deck until they stop. Adjust L106 four turns clockwise and L117 two turns clockwise.
4	L101, L102	1	CHANNEL ELEMENT OUTPUT — Adjust L102 two turns clockwise. Alternately turn L101 and L102 clockwise 1/2 turn at a time until a peak indication is achieved on meter 1.
5	L103, L104	2	FIRST DOUBLER — Tune L103 for a peak reading on meter 2. Tune L104 counterclockwise until meter 2 dips.
6	L104, L105	3	DOUBLE DOUBLER — Tune L105 clockwise until a peak reading is achieved on meter 3. Tune L104 until a peak reading is achieved on meter 3. Repeak L104 and L105 until no further improvement is obtained.
7	L108	4, 5	DISCRIMINATOR — Insert the center conductor of the output cable from a 11.7 MHz test oscillator into the L109 hole on the receiver shield. Do not contact the circuit board. Insert the conductor far enough to obtain a saturated reading on meter 5. By tuning L108, it should then be possible to obtain readings on either side of zero (center) on meter 4. Tune L108 for an EXACT zero (center) reading. *This adjustment is critical.*
8	L109	5	SECOND I-F COIL — Insert the 11.7 MHz injection probe into the L112 hole in the receiver shield. Tune L109 for a peak reading on meter 5, keeping meter 5 out of saturation by moving the probe.
9	C1	4, 5	SECOND OSCILLATOR WARP CAPACITOR — Insert the 45 MHz injection probe into the L112 hole in the receiver shield. Tune C1 until quieting is obtained and meter 5 increases. Tune C1 for an EXACT zero reading on meter 4. *This adjustment is critical.*
10	L110, L111, L112	5	FIRST I-F COILS — Insert the 45 MHz injection probe in the L110 hole on the receiver shield. Tune L112 clockwiise for a peak reading on meter 5, keeping the meter out of saturation by moving the probe. Tune L111 clockwise for a peak reading on meter 5, keeping the meter out of saturation. Remove the probe and turn L110 ten turns clockwise.
11	L106	4, 5	INJECTION FILTER — Unsquelch the receiver and connect an rf signal generator to the antenna connector. Set the rf output level of the generator to maximum and set the generator to the carrier frequency. Tune L106 for a peak reading on meter 5, reducing the generator level as necessary to keep meter 5 out of saturation.
12	L107, L105, L104	3, 5	Detune L105 until meter 3 drops to 10 uA. Tune L107 for a peak reading on meter 5. Tune L105 for a peak reading on meter 3. Repeak L104 and L105 until no further improvement is obtained.
13	L113, L114, L115, L116, L117	5	RF PRESELECTOR — Tune L117, L116, L113, L114 and L115 in that order for a peak reading on meter 5. Reduce the generator level as necessary to keep meter 5 out of saturation.
14	L113, L114, L115, L116, L117	5	Tune L113, L114, L115, L116, L117 in that order for best noise quieting.
15	L110, L111, L112, L109	5	FM modulate the carrier frequency with a 1 kHz tone at 7.5 kHz deviation. Peak L110, L111, L112, and L109 in that order for a maximum reading on meter 5.
16	F1	4	Adjust F1 channel element. Inject a known, accurate carrier frequency into the receiver. Adjust the channel element warp capacitor for a zero reading on meter position 4.
17	—	—	Perform 20 dB quieting sensitivity measurements to check alignment.

MODEL TABLE

Model	Model Breakdown	Description
TRF1032A	TRF1181A TRF6112A TRN6713A	RF Injection Deck Receiver RF & I-F Board Second Oscillator
TRF1181A	TLF6482A TLF6492A	RF Deck Double Doubler

TECHNICAL CHARACTERISTICS

RF Frequency Range		928-960 MHz
Channel Spacing		25 kHz
EIA Modulation Acceptance		±8 kHz minimum
Frequency		Channel element maintains receiver frequency within ±0.0002% of reference frequency from −30°C to +60°C ambient temperature (+25°C reference).
Input Impedance		50 ohms
Sensitivity	20 dB Quieting	0.5 uV
	EIA Sinad	0.35 uV
Selectivity (EIA Sinad)		−80 dB @ ±25 kHz
EIA Sinad Intermodulation		−75 dB
Spurious and Image Rejection		100 dB minimum
Squelch Sensitivity Carrier Squelch (adjustable)		0.25 uV or less at threshold
Tone-Coded Squelch		0.25 uV or less
Digital-Coded Squelch		0.25 uV or less

TRF1032A RF and I-F Board
Alignment Procedure
Motorola No. ***PEPS-35633-O***
12/1/82-UP

REFE
SY

PAR

This
Boar
appli

TLN
Rece

C1 th

C951
C952

CR95
954,

L1 th
6 thr
12,14
21,24
L5,1
23,27
L901

P6

P6

R951

NOTE:
For op
by Mot

(C7
L7
(C37
(C6
L6
(C3
RN6196A AND
RN6308A MODELS
ONLY
C951
C952
TO RCVR RF
ARD
ED CHASSIS INTERCONNECT BOA
RECEIVER FILTER
NOTE 952
RECEIVE
TLN5184A
EXTENDER ON
SWITCH
JU952
NOTE
955

REPEATER STATIONS AND FULL DUPLEX

LTERING COMPONENT USAGE BY MODEL
E ANY FILTERING COMPONENTS, BUT
NG INSTEAD. (PLATING RUNS AND
OT EXIST SIMULTANEOUSLY). SEE PARTS
AND PART NUMBERS'

TLN5655A	TRN6196A	TRN6308A
C5, C10–C14, C19–C25, C27, C30, C36, C40–C44, C49–C55, C57, C60	C1 THRU C60	C1 THRU C60
L5, L10–L14, L19–L25, L27, L30	L1–L30	L1–L30

–FREQUENCY RECEIVERS ONLY.
S ALWAYS ACTIVATED.

ER OPERATION KNOWN AS
D WHEN DESIRABLE. THIS FEATURE
TIVITY" (PL–CODED SQUELCH PLUS
D (CARRIER) SQUELCH).
AUDIO CHANNEL IS ACTIVATED
AND THE CARRIER SQUELCH
D. SINCE THE CARRIER (NOISE–ACTIVATED)
IS ADJUSTABLE, AND SINCE IT IS ONE
S IN THE SQUELCHING OF RECEIVER
E APTLY DESCRIBED AS "VARIABLE PL
ELCH" DENOTES BOTH PL–CODED SQUELCH
TING SIMULTANEOUSLY. CR955, CR956, &
U956 AND JU957 ARE OMITTED FOR
U204 ON AUDIO &S QUELCH BOARD MUST
RT OF THE RECEIVER INTERCONNECT BOARD.

TLN5655A VERSION BOARD TO INTERCON–
NIFIED CHASSIS INTERCONNECT BOARD
T PLUG DIRECTLY INTO THE UNIFIED
S INTERCONNECTED VIA P6. P6 IS
RCONNECT BOARD J AS DETAILED IN
ABLE

FOR REPEAT OR DUPLEX OPERATION

DIGITAL 'PL' CODE OPTION ON

S CONNECTED TO REC SITE DATA

RECEIVER INTERCONNECT BOARD

FUNCTION

Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

Receiver Interconnect Board
Schematic Diagram, Circuit Board Details,
and Parts List
Motorola No. ***PEPS-18067-E***
9/1/80-UP

PARTS LIST

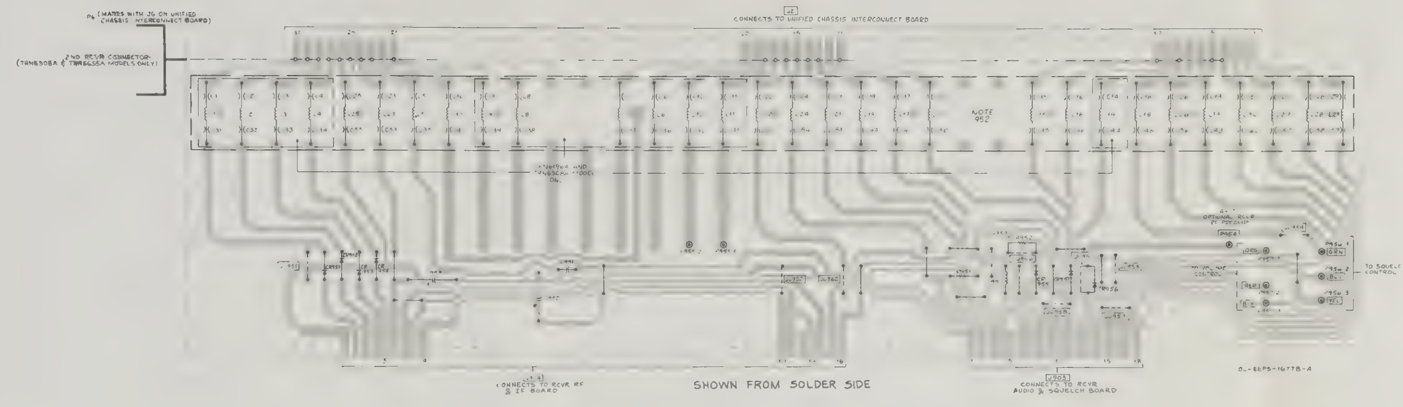
NOTE

This parts list covers five models of the Receiver Interconnect Board. Where differences exist, the model number of the applicable unit is given in the Description column.

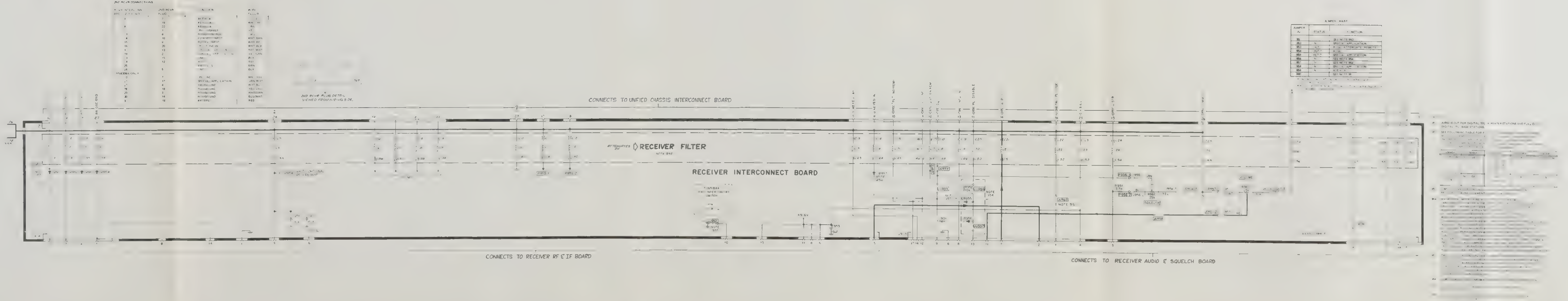
TLN5646A/TLN5648A/TLN5655A/TRN6196A/TRN6308A
Receiver Interconnect Board PL-3435-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1 thru 60	21-861219	1000 pF +100-0%; 500 V (TRN6196A & TRN6308A)
C951	21-82428B59	.01 uF +80-20%; 200 V
C952, 953	23-84762H09	15 uF ±20%; 20 V
		DIODE: (SEE NOTE)
CR951 thru 954, 957	23-84762H09	silicon
		COIL, rf:
L1 thru 4, 6 thru 9, 11, 12, 14, 15 thru 21, 24, 25, 26	24-83961B01	3 turns, coded brown
L5, 10, 13, 22, 23, 27 thru 30	24-83977B01	1-1/2 turns
L901	24-82549D03	1000 uH
		CONNECTOR, plug:
P6	--	(TLN5655A) includes:
	14-84556B01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 14 req'd.
P[illegible]		(TRN6308A) includes:
	14-84556B01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 20 req'd.
		RESISTOR, fixed:
R95[illegible]	6-124C61	3.3k ±10%; 1/4 W
NON-REFERENCED ITEMS		
	7-82626K01	BRACKET, filter
	14-82621K01	INSULATOR (TLN5648A & TLN5655)
	1-80775B75	COVER ASSEMBLY, filter (TLN5646A, TLN5655A, TRN6196A & TRN6308A) includes
	15-82173K01	COVER, filter
	3-138162	SCREW, tapping: 4-40 x 3/8"; 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 4 used (TLN5646A, TLN5648A, TRN6196A & TRN6308A)
	42-84284B01	RETAINER, screw: 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 7 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID; 2 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID (TRN6308A)
	42-82143C03	CLAMP, cable: 1/8" ID (TLN5655A & TRN6308A)
	14-82613M02	INSULATOR

NOTE:
For optimum performance, replacement diodes must be ordered by Motorola part number.


P6 (MATES WITH J6 ON UNIFIED CHASSIS INTERCONNECT BOARD)
2ND RCVR CONNECTOR (TRN6308A & TLN5655A MODELS ONLY)
J2
CONNECTS TO UNIFIED CHASSIS INTERCONNECT BOARD
NOTE 952
OPTIONAL RCVR RF PREAMP
TO VOLUME CONTROL
TO SQUELCH CONTROL
J904
CONNECTS TO RCVR RF & IF BOARD
J903
CONNECTS TO RCVR AUDIO & SQUELCH BOARD
DL-EEPS-16778-A

SHOWN FROM SOLDER SIDE


CONNECTS TO UNIFIED CHASSIS INTERCONNECT BOARD
ATTENUATES RF
RECEIVER FILTER
RECEIVER INTERCONNECT BOARD
+9.6V
CONNECTS TO RECEIVER RF & IF BOARD
CONNECTS TO RECEIVER AUDIO & SQUELCH BOARD

RECEIVER INTERCONNECT BOARD

FUNCTION

Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

Receiver Interconnect Board
Schematic Diagram, Circuit Board Details, and Parts List
Motorola No. PEPS-18067-E
9/1/80-LP

HARDWARE KITS

parts list

TRN5750A/TRN5791A Receiver Link Hardware Kit PL-8335-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-135506	SCREW, tapping: 6-32 × 1/4"; 4 used
	3-136890	SCREW, machine: 4-40 × 9/32"; 10 used
	3-84141D01	SCREW, special captive; 8 used
	15-84254D01	COVER, rear
	15-84255D01	COVER, top
	15-84702N01	COVER, front (TRN5750A only)
	75-84718N01	PAD, rubber
	15-82199P01	COVER, front (TRN5791A only)

TRN5792A/TRN5663A Receiver and Chassis Hardware Kit PL-8334-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		resistor:
R960, 961	18-82515B50	variable; 25k
		mechanical parts
	2-7005	NUT, 6-32 × 1/4 × 3/32"; 3 used
	3-134168	SCREW, tapping: 4-40 × 1/4"; 7 used
	3-134169	SCREW, tapping: 4-40 × 1/4"
	3-135337	SCREW, machine: 6-32 × 9/16"; 3 used
	4-7666	LOCKWASHER, #6 internal; 3 used
	7-84701N01	BRACKET, control
	26-84434D01	HEAT SINK
	26-84275G01	SHIELD, receiver (TRN5663A only)
	26-84410E04	SHIELD, insert (TRN5663A only)
	36-82629H02	KNOB, control; 2 used
	39-10184A24	CONTACT, receptacle; 6 used
	42-10113A26	RETAINER, ring; 8 used
	46-84090C01	STUD, retainer; 8 used
	55-84300B01	HANDLE; 3 used
	26-83820K01	SHIELD, receiver riveted (TRN5792A only)
	26-83820K04	SHIELD, insert (TRN5792A only)

CABLE KITS

parts list

TKN6570A RF Cable Assembly Receiver (W101) PL-5144-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
J103	9-84968D01	BNC bulkhead type
P101	28-82331G01	single contact
		non-referenced item
	30-83794C01	CABLE, coaxial; 17" lg.

TKN8884A RF Cable Assembly Receiver (W101) PL-8348-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
J103	9-84968D01	BNC bulkhead type
P101	28-82331G01	single contact, phono
		non-referenced item
	30-4173E01	CABLE, coaxial; 11" lg.

TKN8307A Cable Receiver Link PL-8187-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	29-847854	LUG, tongue: 4 used
	42-10217A02	STRAP, tie

TKN8269A Cable, RF Receiver PL-8188-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector:
P103	9-82442E01	female; single contact
		cable:
W1	1-80792B99	ASSEMBLY, rf receiver cable; includes:
	3-134212	SCREW, tapping: 4-40 × 5/16"; 4 used
	7-82674L01	BRACKET, relay mounting
	15-483599	HOOD, receptacle
	30-84173E01	CABLE, coaxial shielded: 8" used; reference P103
	3-134212	SCREW, tapping: 4-40 × 5/16"; 2 used

TKN8902A Cable Assembly, Receiver RF PL-8390-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	9-816159	CONNECTOR, type N
	3-134212	SCREW, tapping: 4-40 × 5/16"; 6 used
	7-82674L01	BRACKET, relay mounting
	15-483599	HOOD, receptacle
	30-84173E01	CABLE, coaxial shielded; 8" used
P103	28-84967D01	CONNECTOR, BNC

TKN8004A Low Power Cable Kit (Range I Base Station)
TKN8005A Low Power Cable Kit (Range I Repeater)
TKN8908A Low Power Cable Kit (Link Base Station) PL-6310-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fuse:
F1	65-86099	7.5A; 32 V
		connector, receptacle:
J906	9-83589A01	female; type "BNC", bulkhead
		connector, plug:
P104	28-82331G02	male; type "phono"
P901, 902	28-852527	male; type "N"
P903	28-82398E02	male, right angle; type "N"
P1004		consists of: 15-83498F06 HOUSING, connector; 6-contact and 29-83499F01 TERMINAL, pin; 6 used
P1012	28-852527	male; type "N"
		wire assembly:
W7	1-80775B09	CABLE and CONNECTOR (Rcvr Input Adapter) includes: ref. items P104, J906 and 30-84173E01 CABLE, coaxial; 11" used (TKN8004A, TKN8005A only)
W601	1-80775B84	includes: ref. item P1004 and 9-83012H01 RECEPTACLE, female, wire crimp, 6 used; 42-10217A02 STRAP, tie, 3 used (Power Control Board Interconnect Cable)
		non-referenced items
	1-80709D79	CABLE and CONNECTOR (PA Input) includes: ref. items P901, P1012
	30-84173E01	CABLE, coaxial; 47" used
	1-80709D80	CABLE and CONNECTOR (PA Output) includes: ref. items P902, P903
	30-84173E01	CABLE, coaxial; 18" used
	1-80709D82	FUSE CABLE, assembly includes: ref. item F1
	14-82882A01	INSULATOR, fuse holder body
	14-82883A01	INSULATOR, fuse holder cap
	29-84078B01	LUG, spade; 4 used
	41-82885A01	SPRING, fuse compressor
	42-10217A02	STRAP, tie; 8 used
	42-82884A01	CLIP, fuse; 2 used
	28-817985	ADAPTER, right angle; type "N" (TKN8005A only)

TKN8897A Cable, Receiver RF
TKN8903A Cable, Receiver RF (900 MHz, Non-Unified) PL-8389-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
J103	9-83589A01	single contact
P101	28-87317C01	single contact
		non-referenced item
	30-83794C01	CABLE, coaxial (13" lg. for TKN8897A) (20" lg. for TKN8903A)

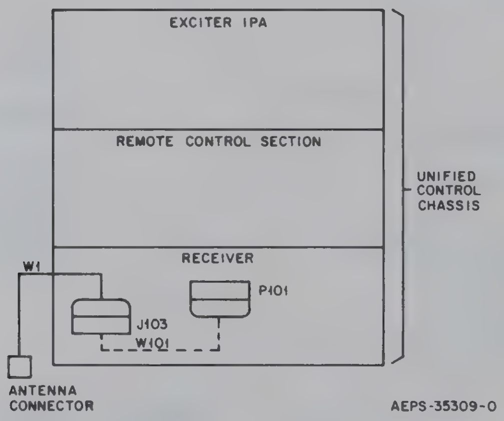
CABLE KITS

parts list

TKN6804A 75 Watt Cable Kit
TKN8905A 75 Watt Cable Kit (Link Stations)

PL-6462-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fuse:
F1	65-86099	7.5A; 32 V
		connector, receptacle:
J501	9-84968D01	female: type "BNC"; bulkhead
J906	9-83589A01	female: type "BNC"; bulkhead
		connector, lug:
P104	28-82331G02	male; type "phono"
P554	9-84886E01	female: type "BNC"; light angle miniature
P1004		consists of:
	15-83498F06	HOUSING, connector; 6-contact
	29-83499F01	TERMINAL, pin; 6 used
		cable assembly:
W7	1-80775B09	includes: ref. items J906, P104 and:
	30-84173E01	CABLE, coaxial; 11" used (TKN6804A only) (Receiver Input Adapter Cable)
W500	1-80775B83	includes: ref. items J501, P554 and:
	30-83794C01	CABLE, coaxial; 6" used (Tripler/Low Level Amplifier Output Adapter Cable)
W601	1-80775B84	includes: ref. items P1004 and:
	9-83012H01	RECEPTACLE, female wire crimp; 6 used
	42-10217A02	STRAP, tie; 3 used (Power Control Board Interconnect Cable)
	non-referenced items	
	1-80775B81	CABLE, hi-current, assembly includes:
	29-82008L02	TERMINAL; 4 used
	30-812505	CABLE, battery: RED; 42" used
	30-851875	CABLE, battery: BLK; 42" used
	42-10217A02	STRAP, tie; 8 used
	1-80775B82	CABLE, fuse, assembly includes: ref. item F1 and:
	14-82882A01	INSULATOR, fuseholder body
	14-82883A01	INSULATOR, fuseholder cap
	29-847854	LUG, slotted tongue; 4 used
	41-82885A01	SPRING, fuse compressor
	42-10217A02	STRAP, tie; 5 used
	42-82884A01	CLIP, fuse; 2 used



AEPS-35309-0

NOTE: TKN6570A is used with 72-76 MHz models
TKN8884A is used with 450-470 MHz models
TKN8897A is used with 928-960 MHz models

MOTOROLA

PURC™

Radio Paging Station

928-960 MHz Transmit

This Manual Must be Used With Control and Applications Manual 68P81060E70

68P81062E70-O

COMMERCIAL WARRANTY
(STANDARD)

Motorola radio communications products are warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR, (except for crystals and channel elements which are warranted for a period of ten (10) years) from the date of shipment. Parts, including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola Communications and Electronics, Inc., 1301 E. Algonquin Road, Schaumburg, Illinois 60196, to the original purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by seller, or if appropriate, to specifications accepted by Seller in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof, and such action on the part of Motorola shall be the full extent of Motorola's liability hereunder.

This warranty is void if:

a. the product is used in other than its normal and customary manner;
b. the product has been subject to misuse, accident, neglect or damage;
c. unauthorized alterations or repairs have been made, or unapproved parts used in the equipment.

This warranty extends only to individual products, batteries are excluded, but carry their own separate limited warranty. Because each radio system is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty except by a separate written agreement signed by an officer of Motorola.

Non-Motorola manufactured products are excluded from this warranty, but subject to the warranty provided by their manufacturers, a copy of which will be supplied to you on specific written request.

In order to obtain performance of this warranty, purchaser must contact its Motorola salesperson or Motorola at the address first above shown, attention Quality Assurance Department.

This warranty applies only within the United States.

EPS-27734-O

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EPS-34440-B

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81062E70-0 PURC Radio Paging Station

REVISION DETAILS:

The Receiver Alignment procedure (PEPS-35633) located in the Receiver section (68P81063E26) has been modified. Replace the existing receiver alignment procedure with this updated receiver alignment procedure. See the reverse side of this page.

D. RECEIVER ALIGNMENT

Step	Adjust	Meter Position	Stage and Procedure
1	L101, L102, L103, L104, L105		MULTIPLIER COILS — Adjust the cores of L101, L102, L103, and L105 to the end of the coil form flush with the printed circuit board. Adjust the core of L104 to the end of the coil form away from the printed circuit board.
2	L110, L111, L112		FIRST I-F COILS — Adjust the cores of L110, L111, and L112 to the end of the coil form flush with the printed circuit board.
3	L106, L107, L113, L114, L115, L116, L117		PRESELECTOR AND INJECTION FILTER — Adjust the slugs at L106, L107, and L113 through L117 away from the rf deck until they stop. Adjust L106 four turns clockwise and L117 two turns clockwise.
4	L101, L102	1	CHANNEL ELEMENT OUTPUT — Adjust L102 two turns clockwise. Alternately turn L101 and L102 clockwise 1/2 turn at a time until a peak indication is achieved on meter 1.
5	L103, L104	2	FIRST DOUBLER — Tune L103 for a peak reading on meter 2. Tune L104 counterclockwise until meter 2 dips.
6	L104, L105	3	DOUBLE DOUBLER — Tune L105 clockwise until a peak reading is achieved on meter 3. Tune L104 until a peak reading is achieved on meter 3. Repeak L104 and L105 until no further improvement is obtained.
7	L108	4, 5	DISCRIMINATOR — Insert the center conductor of the output cable from a 11.7 MHz test oscillator into the L109 hole on the receiver shield. Do not contact the circuit board. Insert the conductor far enough to obtain a saturated reading on meter 5. By tuning L108, it should then be possible to obtain readings on either side of zero (center) on meter 4. Tune L108 for an EXACT zero (center) reading. *This adjustment is critical.*
8	L109	5	SECOND I-F COIL — Insert the 11.7 MHz injection probe into the L112 hole in the receiver shield. Tune L109 for a peak reading on meter 5, keeping meter 5 out of saturation by moving the probe.
9	C1	4, 5	SECOND OSCILLATOR WARP CAPACITOR — Insert the 45 MHz injection probe into the L112 hole in the receiver shield. Tune C1 until quieting is obtained and meter 5 increases. Tune C1 for an EXACT zero reading on meter 4. *This adjustment is critical.*
10	L110, L111, L112	5	FIRST I-F COILS — Insert the 45 MHz injection probe in the L110 hole on the receiver shield. Tune L112 clockwiise for a peak reading on meter 5, keeping the meter out of saturation by moving the probe. Tune L111 clockwise for a peak reading on meter 5, keeping the meter out of saturation. Remove the probe and turn L110 ten turns clockwise.
11	L106	4, 5	INJECTION FILTER — Unsquelch the receiver and connect an rf signal generator to the antenna connector. Set the rf output level of the generator to maximum and set the generator to the carrier frequency. Tune L106 for a peak reading on meter 5, reducing the generator level as necessary to keep meter 5 out of saturation.
12	L107, L105, L104	3, 5	Detune L105 until meter 3 drops to 10 uA. Tune L107 for a peak reading on meter 5. Tune L105 for a peak reading on meter 3. Repeak L104 and L105 until no further improvement is obtained.
13	L113, L114, L115, L116, L117	5	RF PRESELECTOR — Tune L117, L116, L113, L114 and L115 in that order for a peak reading on meter 5. Reduce the generator level as necessary to keep meter 5 out of saturation.
14	L113, L114, L115, L116, L117	5	Tune L113, L114, L115, L116, L117 in that order for best noise quieting.
15	F1	4	Adjust F1 channel element. Inject a known, accurate carrier frequency into the receiver. Adjust the channel element warp capacitor for a zero reading on meter position 4.
16	L110, L111, L112, L109	5	FM modulate the carrier frequency with a 1 kHz tone at 7.5 kHz deviation. Peak L110, L111, L112, and L109 in that order for a maximum reading on meter 5.
17	—	—	Perform 20 dB quieting sensitivity measurements to check alignment.

MOTOROLA INC.

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81062E70-0	*PURC* Radio Paging Station 928-960 MHz Transmit

REVISION DETAILS:

This revision updates the field service procedures for the Final Power Amplifier/Blower Shroud section (68P81063E24-0) located under the TRANSMITTER tab in your manual. The revised section describes the routine or emergency maintenance of the tube cavity which is part of the TLF1222A Final Power Amplifier. This maintenance procedure includes tube removal, tube and cavity cleaning, and tube installation procedures. Replace the existing Final Power Amplifier/Blower Shroud section with the attached, revised section.

ATTACHMENTS:

Final Power Amplifier/Blower Shroud
Installation Instruction section......................68P81063E24-A

MOTOROLA INC.
Communications
Sector

FINAL POWER AMPLIFIER
MODEL TLF1222A
BLOWER AND SHROUD
MODEL TRN6729A

TLF1222A
Final PA Model Complement

Model	Description
TKN6835A	Cable Kit
TLF6472A	Amplifier Cavity
TRN4850A	Chassis and Hardware Kit
TRN6588A	Control Logic Board

1. FUNCTIONAL OPERATION

The output from the directional coupler is applied to the final power amplifier input coupling. The rf carrier is applied to an EIMAC 3CX400U7/8961 UHF Transmitting Triode designed primarily for the 928 to 960 MHz frequency spectrum. In the supplied grounded grid, cathode driven configuration, the tube provides 125 W of final rf output power. The carrier is coupled through a low pass harmonic filter to the antenna.

2. ALIGNMENT PROCEDURE

WARNING
High voltages are present when power is applied to the station. Under no circumstances should the station be operated with any of the power amplifier cavity screws loose. The adjustable wall screws must all be tightened before applying power to the station. Attempting to tune the adjustable walls with power applied is both improper and dangerous.

2.1 PRELIMINARY ADJUSTMENT

Step 1. Insure that no ac power is applied to the station.

Step 2. Before attempting to align the power amplifier, insure that the exciter, IPA, and low voltage power supply adjustments have been made.

Step 3. Connect a 250 watt wattmeter between the antenna output connector and the antenna.

Step 4. Loosen locking screws on the output coupling, output fine tuning, input coupling, and input fine tuning controls.

Step 5. Set the controls on amplifier as indicated below. (See Figure 1.)

- OUTPUT TUNING CONTROL — Fully ccw (as looking down on the cavity) or control knob fully extended out.
- PLATE CURRENT CONTROL — Fully ccw.
- OUTPUT COUPLING CONTROL — Fully ccw (as looking down on cavity) or control knob fully in.

Step 6. Tighten down *all* screws on power amplifier cavity, front and rear. This step is important to insure proper operation of the cavity.

2.2 TUNING PROCEDURE

NOTE
For multifrequency stations all see section 68P81065E88.

After making preliminary adjustments, perform the following tuning procedure.

Step 1. Apply power to the station. After the transmitter is enabled by the transmit inhibit circuitry (see section 68P81031E53) in the Power Supplies section, key the station. Slide the coarse input coupling control in and out. Observe the best dip on power control Meter 2 reading.

Scotch Brite-Pad is a registered trademark of 3M Inc.

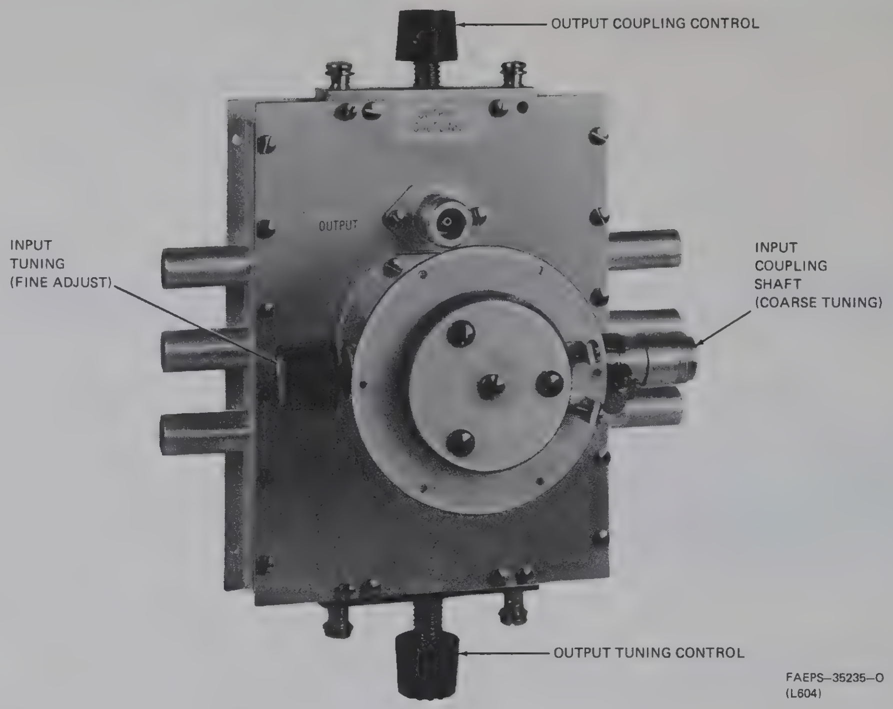


Figure 1. Final Power Amplifier Controls

NOTE

The dip can be very sharp, so move the control very slowly in small amounts.

Step 2. Alternately turn the input coupling and input tuning controls for minimum reflected power (power control Meter 2).

Step 3. Alternately turn the output coupling and output tuning controls for maximum power output.

Step 4. Increase the plate current adjustment control to achieve approximately 300 mA or 125 W rf output, whichever comes first.

Step 5. Adjust the input tuning and input coupling controls to minimum power control Meter 2 reading.

Step 6. Adjust output tuning and output coupling controls for maximum power output. Continue adjustments until no further improvement can be obtained.

Step 7. Adjust the plate current control to achieve 125 W rf output from the station.

Step 8. Tighten down the output coupling and tuning controls and then the input coupling shaft and tuning control.

3. MAINTENANCE AND TROUBLESHOOTING

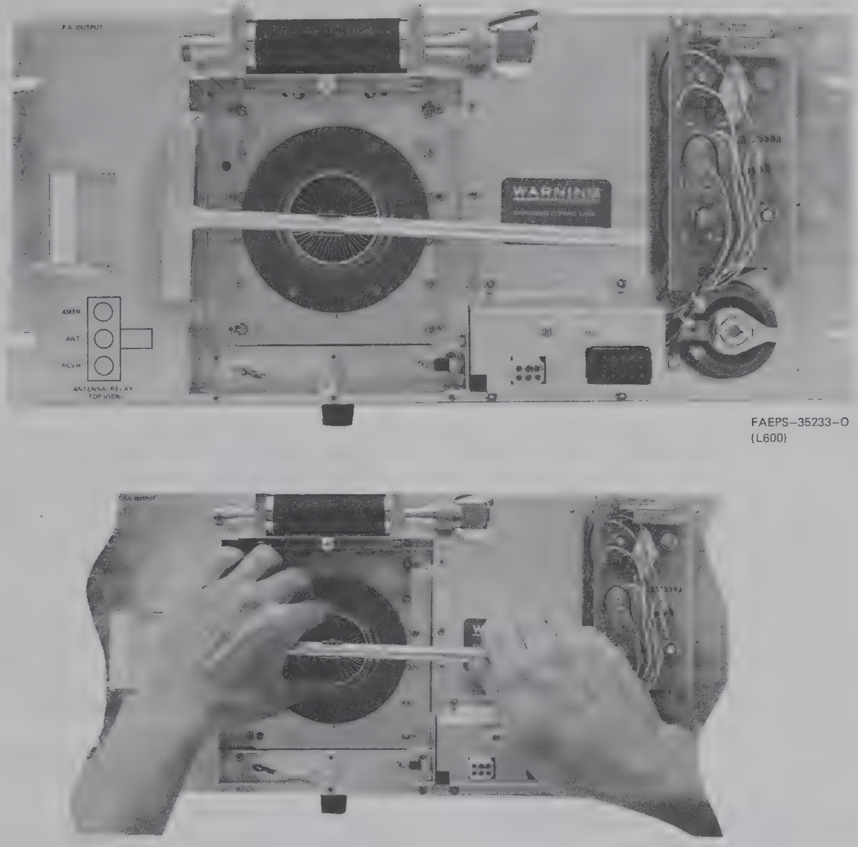
3.1 PERFORMANCE CHECKS

The power amplifier should be periodically checked for proper operation. Refer to Table 1 for typical PA check points and normal readings.

3.2 TROUBLESHOOTING

If the above performance tests indicate a PA malfunction, refer to the appropriate step in the following troubleshooting procedure.

Step 1. Apply power to the station. Measure the filament voltage. If voltage is below 6.3 volts, adjust the filament voltage (see section 68P81031E53, paragraph 4). If the voltage is zero, check the filament regulator board on the low voltage power supply.



FAEPS–35233–O
(L600)

FAEPS–35234–O
(O600)

Figure 2. PA Tube Pulling Procedure

Step 2. Measure the plate voltage. If less than 1500 V dc, check the high voltage power supply (section 68P81031E52).

Table 1. Typical Final PA Meter Readings

Test Point	Meter Reading	
	Keyed	**Unkeyed**
Filament Voltage	4.8 V dc	6.3 V dc
Plate Voltage	1500 V dc	1500 V dc
PA Current	300 mA	—
Reflected Power	—	—
Power Output	60-125 Watts Variable	—

Step 3. Key the station and measure the output power. If power is low, perform Steps 4 through 7. If power is zero, perform Steps 8 through 9.

Step 4. Measure the filament voltage. If a value other than 4.8 V dc is obtained, adjust the filament voltage (see section 68P81031E53, paragraph 4).

Step 5. Measure the plate current. If low or high, adjust R900 to obtain a normal reading and retune the output coupling and tuning. If the plate current is zero, check the high voltage power supply (section 68P81031E52).

Step 6. Measure the power output. If output is low, retune the entire PA (see paragraph 3.2).

Step 7. If power output is still low, replace the PA tube (see paragraph 3.3).

Step 8. Measure the filament voltage. If other than 4.7 V dc, check the filament regulator board.

Step 9. Measure the plate current. If low, remove the cover to the TRN6588A Control Logic Board. Measure the collector voltage at Q900 (25 V dc unkeyed, 0 V dc keyed). If abnormal readings are obtained, check the biasing circuitry. If the biasing is functioning properly, replace Q900.

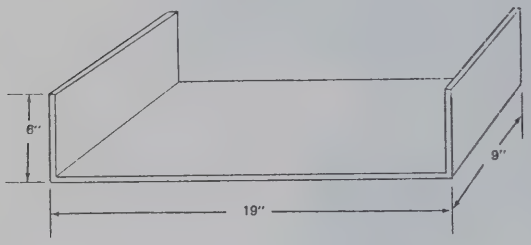
3.3 TUBE REPLACEMENT AND SERVICING

To facilitate cavity maintenance, the Final Power Amplifier (FPA) should be removed from the station and placed in a U-shaped wooden holding fixture (see

Figure 3 Final Power Amplifier Holding Fixture). This will re-orient the FPA into a horizontal position for ease of servicing. In the event the FPA is not removable from the station, this service procedure should be followed as close as possible with the FPA still racked in the station.

NOTE

Item numbers referred to in this section correspond to the numbers indicated on the Parts Location Detail drawing, GEEPS-35173-O, which is part of PEPS-35613-A, also in this secton.



GAEPS-38767-O

Figure 3. Power Amplifier Holding Fixture

3.3.1 Tube Removal

CAUTION

Do not mix hardware. Reassemble using same hardware from original slots.

Step 1. Remove all voltages from the cavity, tripler and doubler (TLF1202A), and station.

Step 2. Disconnect the power and coaxial cables from the FPA, driver, and antenna or any auxiliary power measuring devices.

Step 3. Disconnect and remove blower and cover.

Step 4. Remove the FPA panel (TLF1222A) from the station and place the panel on the holding fixture (see Figure 3) with the back side of the FPA facing up.

Step 5. Examine the power receptacles; J8, J12, J900, and plugs P8, P12, P900 for broken or misaligned pins. Repair or replace the receptacles or plugs if necessary.

Step 6. Remove the protective cover over the control logic board (TRN6588A) and potentiometer R900. Clean the area of dust and inspect and tighten connections. Repair if necessary. Replace cover.

Step 7. Remove cap from tube anode (V901, item #45). If desired, the slot-head screw may be replaced with an equivalent Allen-head screw for easier removal and replacement of the anode cap.

Step 8. Remove the circular phenolic anode clamp ring (item #24) held in position by six screws with lockwashers.

Step 9. Position the tube puller (Motorola part No. 1-80740D54) with the lifting fingers under the top cap of the tube. The puller must remain parallel to the surface of the cavity during tube removal. See Figure 2, page 3 of this section.

CAUTION

Tube puller should be marked '900 MHz ONLY'.

Step 10. With the tube puller in place, pull slowly on the handle with the right hand while guiding the tube as necessary with the left hand. Do not twist the tube during removal and do not allow the tube to "bump" the finger stock. Note that the anode collet (item #29) is still on the anode heat exchanger as the tube comes free of the cavity. The anode insulating ring (anode insulator, item #25) remains on the cavity.

Step 11. With the tube and anode collet assembly free of the cavity, ***hold the anode collet in two hands with the plate cap of the tube facing you.***

Step 12. Press down on the anode of the tube with your thumbs with even pressure while pulling up on the anode collet with your fingers. In this way, the tube slowly passes through the anode collet. Do not let the tube drop out of the anode collet when the tube and anode collet separate from each other. Use caution to prevent damaging the tube.

Step 13. Remove the anode insulating ring (item #25) from the cavity. Clean any dust and dirt from the anode insulating ring with a mild solvent (denatured alcohol or acetone for example) and examine for punctures or cracks in the copper or in the insulation. Look for signs of discoloration or water condensation. Replace the ring if damaged or permanently discolored. If a new anode insulating ring is used, perform the above cleaning procedure on the ring before installing it into the cavity.

Step 14. Examine the anode collet (item #29). Clean the dust from the anode collet with a small brush. If any fingers are missing or bent, replace the anode collet as cavity power output and tuning may be affected.

Step 15. Clean the surface of the cavity under the anode collet with denatured alcohol or acetone.

Step 16. Remove the four screws and lockwashers that hold the grid collet assembly (item #27) to the lower cavity plate. Remove the grid collet and clean the dust from the finger stock with a soft brush and denatured alcohol or acetone.

Step 17. Blow the dust from the interior of the cavity. Small cans of pressurized clean air are available at most photographic stores. Carefully clean the cavity inner surface (particularly around the input and output coupler mechanisms) with a soft brush dipped in denatured alcohol or acetone.

Step 18. Examine the filament contact ring (items #10 and #12) and clean with pressurized air. Replace the contact ring if fingers are broken or bent.

Step 19. Reinstall the grid collet assembly (item #27).

NOTE

> It is very important that the grid collet assembly be aligned properly with the grid contact ring. Improper alignment results in broken finger stock and uneven contact pressure on the grid contact ring.

To align the grid collet assembly, mount the collet on the lower cavity plate. Insert, but do not fully tighten, the four mounting screws. After the assembly is loosely mounted, carefully insert the tube into the socket making sure the tube is properly seated. This action aligns the grid collet assembly. Using a small screwdriver, tighten the four mounting screws and lockwashers on the grid collet assembly. Carefully remove the tube straight out from the socket to avoid any twisting or bending motion.

Step 20. Turn the FPA over on the stand so the front side is face up.

Step 21. Remove the blower filters, clean and reinstall according to the procedure outlined in paragraph 4.2 of this section.

Step 22. Remove the input cover plate (Motorola part No. 15-82307L01) of the cavity by loosening the six captivated Phillips screws in the plate.

Step 23. Blow away any loose dirt from the input area under the cover plate. Inspect and tighten the filament connections on the side of the cavity.

Step 24. Check the three bolts around the circumference of the cavity contact assembly (item #10) for tightness.

NOTE

> These bolts should be tight enough to compress the lock- washers. If excessively tight, the compressive force may puncture the insulating dielectric in the cavity contact assembly.

Step 25. Check the center bolt of the cavity contact assembly for tightness.

Step 26. Reinstall the input cover plate described in Step 22.

Step 27. Check all bolts around the perimeter of the cavity and center contact assembly for tightness.

3.3.2 Tube and Cavity Cleaning

NOTE

> If the original tube is to be re-used, inspect and clean the cavity before insertion.

Step 1. The anode collet (item #29) should be round with no serious indentations as this leads to poor contact between the anode of the tube and finger stock of the anode collet.

Step 2. The anode cooling fins on the tube should be free of dust and dirt. The fins can be cleaned by immersing the tube in a solution of warm water and TSP (trisodium phosphate). Methanol may be used as a substitute for the TSP. After cleaning, rinse the anode thoroughly and blow free of moisture.

Step 3. When the tube is dry, clean the outer anode ring (especially the area contacted by the anode collet) with a light abrasive such as a green Scotch Brite-Pad® .

Step 4. Clean the ceramic envelope cylinder between the plate and grid with a cloth moistened with water and TSP. Rinse the cylinder with clean water to remove any TSP residue.

Step 5. Clean the grid contact ring with a light abrasive such as a green Scotch Brite-Pad® . After cleaning, rinse the grid contact ring with warm water and then dry.

Step 6. Using compressed clean air, blow away any dust and dirt clear of the heater and cathode rings.

Step 7. Before re-assembly, check all the internal surfaces, especially in the anode insulating ring area for any damage such as burrs or sharp edges which may have occurred during disassembly.

3.3.3 Tube Installation

NOTE

> Before performing the tube insertion procedure, assemble the anode collet (item #29) and the phenolic anode clamp ring (item #24). The collet should fit in the phenolic ring with enough edge clearance to permit the collet to "float" after assembly.

Step 1. Place the tube on a flat surface, sitting on the plate cap.

Step 2. Position the anode collet (item #29) by hand above the tube, flat side up, and then gently and evenly press onto the tube. Continue pressing until the collet has moved about three quarters of the way down the anode structure. The collet should be parallel to the surface on which the tube is resting.

Step 3. Place the anode insulating ring (anode insulator, item #25) on top of the cavity opening. Center the ring between the screw holes. It is important that the capacitor *must* remain centered during the tube and anode collet assembly procedure. Misalignment results in a short circuit condition when high voltage is applied to the tube anode. To secure the ring during assembly, use a piece of cellophane tape. Apply the tape only to the outermost edge of the anode insulating ring. The tape may remain there after assembly is completed.

Step 4. Make sure the grid insulating ring is in place within the grid collet. Pick up the tube and collet assembly and, holding the tube by the plate cap, insert the assembly into the cavity which is sitting in the stand. Direct the tube base at the center heater contact assembly (item #10).

Step 5. Gently and evenly press the tube into the cavity until the tube bottoms. Use straight-in pressure and do not rock the tube or use any twisting motion. The tube must be fully seated to assure overall contact with the grid collet.

Step 6. Recheck proper alignment with the anode insulating ring (item #25) under the anode collet (item #29). Press the anode collet and insulating ring against cavity wall. Check to see if the anode insulating ring is still centered and align if necessary.

Step 7. The anode collet and tape hold the anode insulating ring in position while the phenolic anode clamp ring (item #24) is positioned and fastened in place with the six screws and lockwashers. Attach the cap to the tube anode.

Step 8. Reinstall the FPA chassis in the transmitter cabinet. Also install the blower and cover. Reconnect all cables to the FPA.

Step 9. Perform the entire tune-up procedure as outlined in paragraphs 2.1 and 2.2.

4. TRN6729A BLOWER AND SHROUD

4.1 GENERAL

The blower and shroud provides cooling for the PA tube and vents the heated air outside the cabinet. The assembly does not provide cooling for other cabinet components.

4.2 BLOWER FILTER CLEANING PROCEDURE

To insure proper operation, the filters for the PA blower must be cleaned once every six months.

Step 1. Remove filters from blower assembly.

Step 2. Clean filters either by rinsing in warm water or thoroughly vacuuming them.

Step 3. Allow filters to completely dry and replace them.

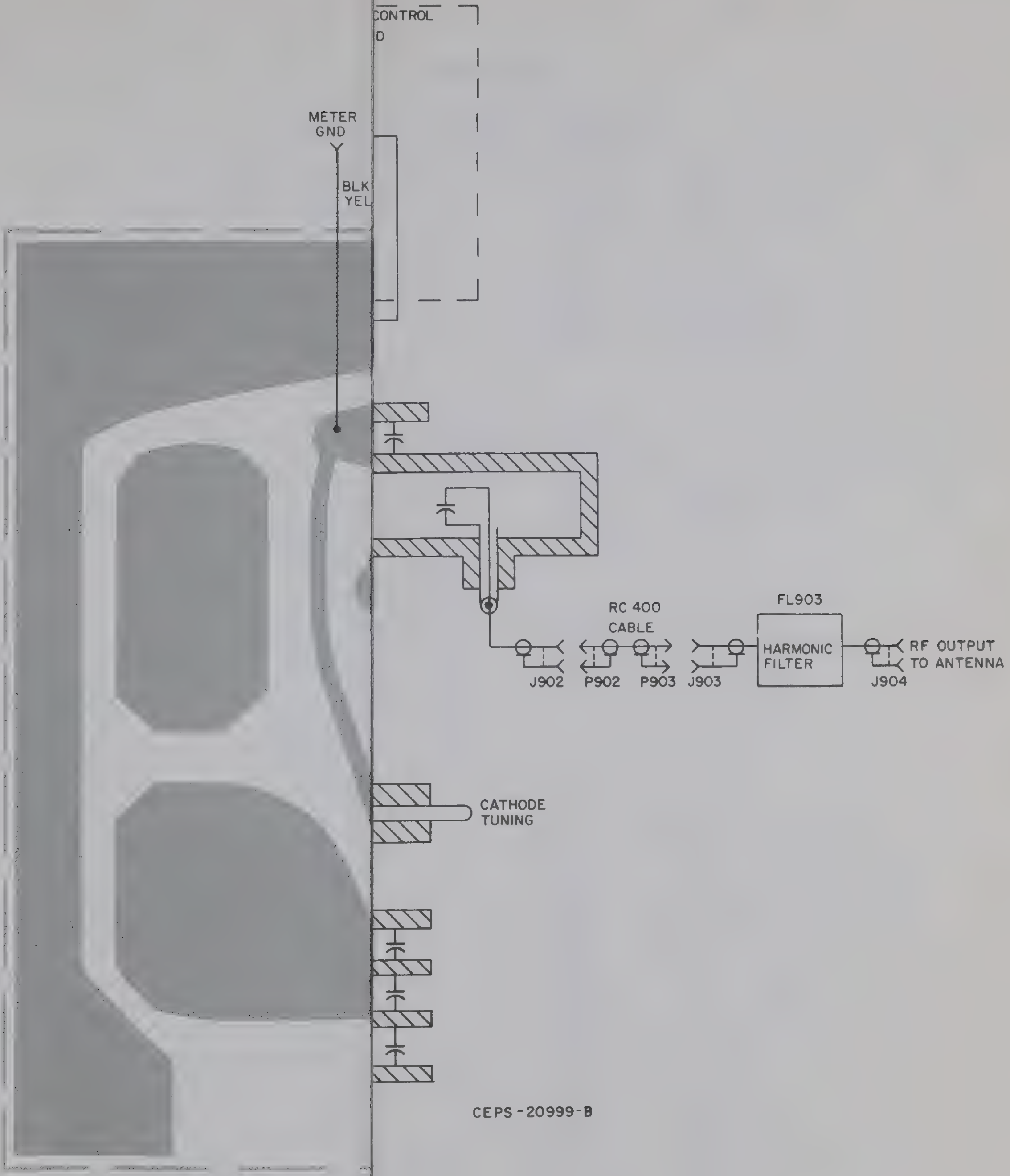
NOTE

The station can remain in operation during filter cleaning. In dusty environments, they should be cleaned more frequently (see table below).

Type of Environment	Frequency of Cleaning Filters
Heavy industrial or very dusty outdoor	Each Month
Outdoor (Average Dust)	3 Months
Average Industrial (Indoor)	6 Months
Average Residental (Indoor)	6 Months

4.3 BLOWER MAINTENANCE

The blower normally does not require maintenance. The blower motor contains lifetime lubricated, sealed bearings.


CONTROL
D
METER GND
BLK
YEL
RC 400 CABLE
FL903
HARMONIC FILTER
J902
P902
P903
J903
J904
RF OUTPUT TO ANTENNA
CATHODE TUNING
CEPS-20999-B

PARTS LISTS SHOWN ON BACK OF THIS DIAGRAM

TLF1222A Final Power Amplifier
Schematic Diagram and Circuit Board Detail
Motorola No. ***PEPS-35507-A***
1/26/84-UP

Step 3. Place the anode insulating ring (anode insulator, item #25) on top of the cavity opening. Center the ring between the screw holes. It is important that the capacitor *must* remain centered during the tube and anode collet assembly procedure. Misalignment results in a short circuit condition when high voltage is applied to the tube anode. To secure the ring during assembly, use a piece of cellophane tape. Apply the tape only to the outermost edge of the anode insulating ring. The tape may remain there after assembly is completed.

Step 4. Make sure the grid insulating ring is in place within the grid collet. Pick up the tube and collet assembly and, holding the tube by the plate cap, insert the assembly into the cavity which is sitting in the stand. Direct the tube base at the center heater contact assembly (item #10).

Step 5. Gently and evenly press the tube into the cavity until the tube bottoms. Use straight-in pressure and do not rock the tube or use any twisting motion. The tube must be fully seated to assure overall contact with the grid collet.

Step 6. Recheck proper alignment with the anode insulating ring (item #25) under the anode collet (item #29). Press the anode collet and insulating ring against cavity wall. Check to see if the anode insulating ring is still centered and align if necessary.

Step 7. The anode collet and tape hold the anode insulating ring in position while the phenolic anode clamp ring (item #24) is positioned and fastened in place with the six screws and lockwashers. Attach the cap to the tube anode.

Step 8. Reinstall the FPA chassis in the transmitter cabinet. Also install the blower and cover. Reconnect all cables to the FPA.

Step 9. Perform the entire tune-up procedure as outlined in paragraphs 2.1 and 2.2.

4. TRN6729A BLOWER AND SHROUD

4.1 GENERAL

The blower and shroud provides cooling for the PA tube and vents the heated air outside the cabinet. The assembly does not provide cooling for other cabinet components.

4.2 BLOWER FILTER CLEANING PROCEDURE

To insure proper operation, the filters for the PA blower must be cleaned once every six months.

Step 1. Remove filters from blower assembly.

Step 2. Clean filters either by rinsing in warm water or thoroughly vacuuming them.

Step 3. Allow filters to completely dry and replace them.

NOTE

The station can remain in operation during filter cleaning. In dusty environments, they should be cleaned more frequently (see table below).

Type of Environment	Frequency of Cleaning Filters
Heavy industrial or very dusty outdoor	Each Month
Outdoor (Average Dust)	3 Months
Average Industrial (Indoor)	6 Months
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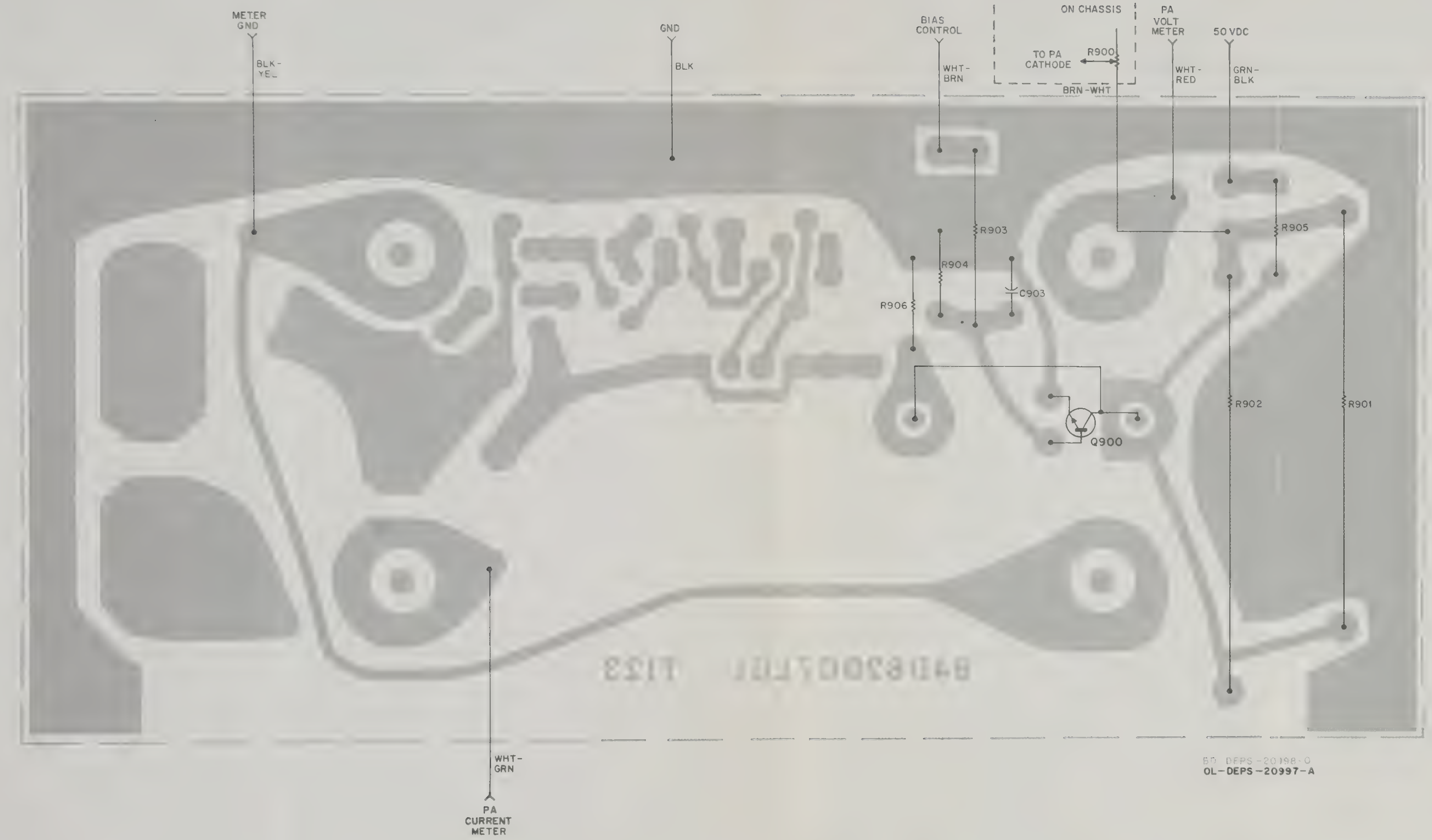
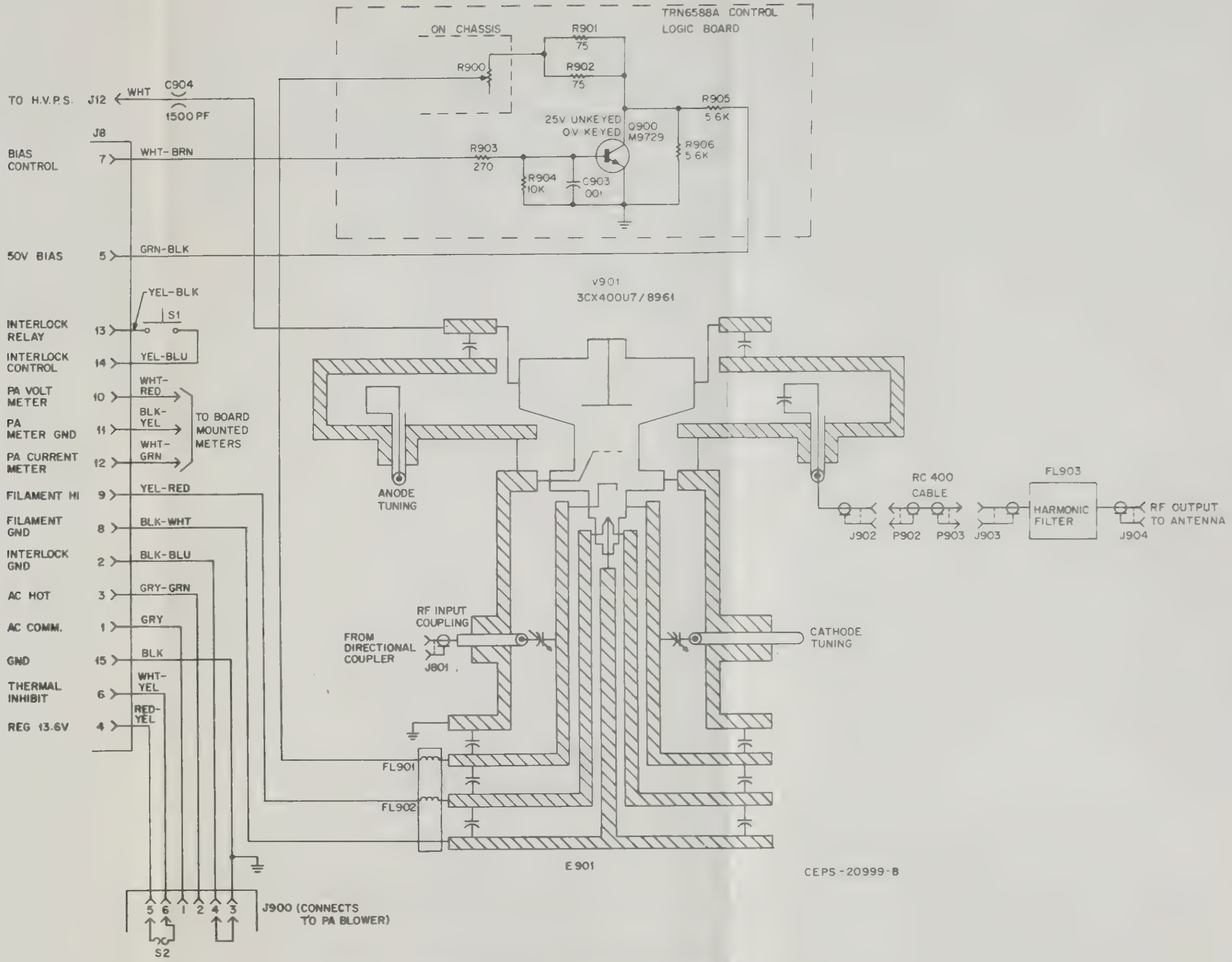
4.3 BLOWER MAINTENANCE

The blower normally does not require maintenance. The blower motor contains lifetime lubricated, sealed bearings.


METER GND
BLK-YEL
GND
BLK
BIAS CONTROL
WHT-BRN
ON CHASSIS
TO PA CATHODE
R900
BRN-WHT
PA VOLT METER
WHT-RED
50 VDC
GRN-BLK
R903
R904
R906
C903
R905
Q900
R902
R901
WHT-GRN
PA CURRENT METER
BD-DEPS-20998-O
OL-DEPS-20997-A


TRN6588A CONTROL LOGIC BOARD
ON CHASSIS
R900
R901 75
R902 75
R905 5.6K
R906 5.6K
25V UNKEYED
0V KEYED
Q900 M9729
R903 270
R904 10K
C903 .001
TO H.V.P.S. J12
WHT
C904 1500 PF
J8
BIAS CONTROL 7
WHT-BRN
50V BIAS 5
GRN-BLK
YEL-BLK
S1
INTERLOCK RELAY 13
INTERLOCK CONTROL 14
YEL-BLU
PA VOLT METER 10
WHT-RED
PA METER GND 11
BLK-YEL
PA CURRENT METER 12
WHT-GRN
TO BOARD MOUNTED METERS
FILAMENT HI 9
YEL-RED
FILAMENT GND 8
BLK-WHT
INTERLOCK GND 2
BLK-BLU
AC HOT 3
GRY-GRN
AC COMM. 1
GRY
GND 15
BLK
THERMAL INHIBIT 6
WHT-YEL
REG 13.6V 4
RED-YEL
5 6 1 2 4 3
S2
J900 (CONNECTS TO PA BLOWER)
V901
3CX400U7/8961
ANODE TUNING
RF INPUT COUPLING
FROM DIRECTIONAL COUPLER
J801
CATHODE TUNING
FL901
FL902
E901
RC 400 CABLE
J902
P902
P903
J903
FL903
HARMONIC FILTER
J904
RF OUTPUT TO ANTENNA
CEPS-20999-B

Model Table

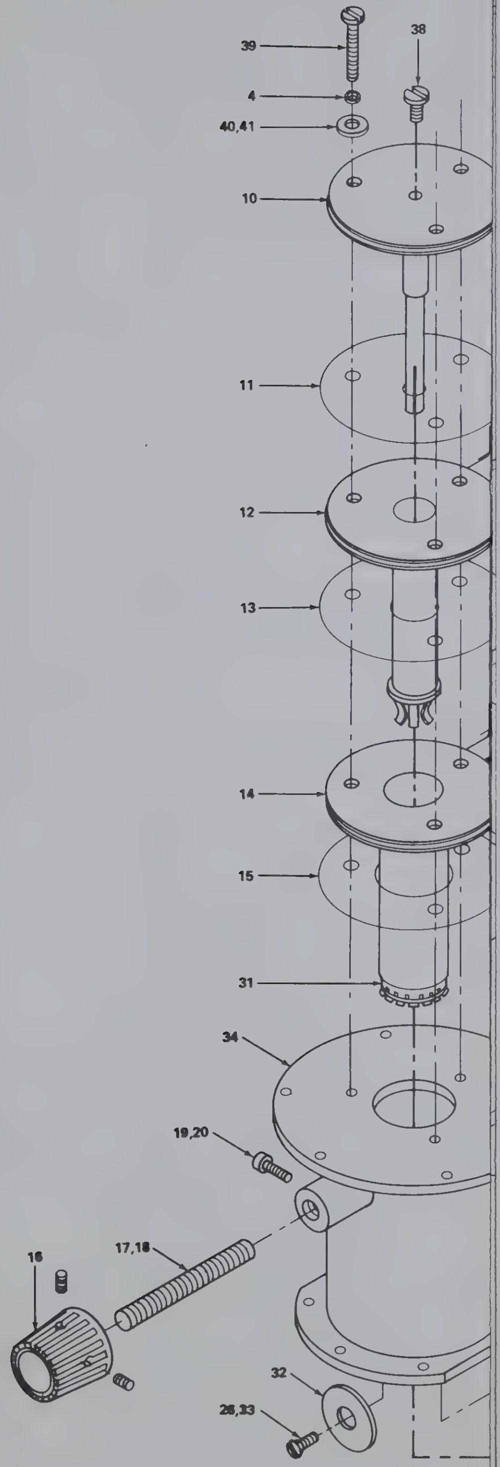
Model	Sub-Model	Suffix	Description
TLF1222A	TKN6835A		Transmitter Cable
	TLF6472A		Amplifier Cavity
	TRN4850A		Chassis & Hardware Kit
	TRN6588A		Control Logic Board
TRN6729A			Blower Kit
TRN6572A			Antenna Relay Kit

PARTS LISTS SHOWN ON
BACK OF THIS DIAGRAM

TLF1222A Final Power Amplifier
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-35507-A
1/26/84 UP

TLF1222A Final Power Amplifier Mechanical Parts List PL-8313-O

ITEM	MOTOROLA PART NO.	DESCRIPTION
1	1-82479N01	TUNING ASSY.-R.H.
2	54-82479N02	LABEL, tuning
3	—	SCREW, machine: 4-40 × 5/16"; 28 used
4	4-8442	LOCKWASHER, #4 split; 45 used
5	1-82479N03	SIDE BAR ASSY.; 2 used
6	54-82479N04	LABEL, output
7	3-1237	SCREW, machine: 4-40 × 1/4"; 12 used
8	1-82479N04	OUTPUT CONNECTOR ASSY.
9	1-82479N05	TUNING ASSY.-L.H.
10	39-82479N06	CONTACT ASSY., heater
11	14-82479N07	INSULATOR, inner heater (dielectric)
12	39-82479N08	CONTACT ASSY., outer heater
13	14-82479N09	INSULATOR, outer heater (dielectric)
14	38-82479N10	CONTACT ASSY., cathode collet
15	14-82479N11	INSULATOR, cathode (dielectric)
16	36-82479N12	KNOB, control
17	3-82479N13	SCREW, probe
18	11-82479N14	LUBRIPLATE (930 AA), as required
19	3-1587	SCREW, machine: 6-32 × 5/16"
20	4-82418B03	WASHER, insulating; 1/12 used
21	64-82479N15	GRID PANEL ASSY.
22	64-82479N16	PANEL, anode
23	3-1534	SCREW, machine: 4-40 × 7/16"; 6 used
24	42-872479N17	CLAMP, ring-anode
25.	14-82479N18	INSULATOR, anode (dielectric)
26	3-1938	SCREW, machine: 4-40 × 1/4"; 6 used
27	1-82479N19	GRID COLLET ASSY.
28	14-82479N20	WASHER, insulating
29	1-82479N21	ANODE COLLET ASSY.
30	54-82479N22	LABEL, high voltage
31	42-82479N23	SPRING, cathode collet
32	49-82479N24	DISK, probe; 2 used
33	11-82479N25	LOCTITE, grade CV; as required
34	15-82479N26	HOUSING ASSY.
35	58-82479N27	SLIDING PROBE ASSY.
36	42-82479N28	CLAMP, hose
37	54-82479N29	LABEL, coupling
38	3-8031	SCREW, machine: 6-32 × 1/4"; 3 used
39	3-1413	SCREW, machine: 4-40 × 5/8"; 3 used
40	4-114057	WASHER, flat: #4; 3 used
41	14-82479N30	INSULATOR, screen; 9 used
42	54-82479N31	LABEL, logo
43	3-7342	SCREW, machine: 6-32 × 3/8"; 4 used
44	11-82479N32	TAPE, kapton: 13/16" long
45	97-10794A01	TUBE, transmitting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TLF1222A Final Power Amplifier
Parts Location Detail
Motorola No. PEPS-35613-A
1/26/84-UP

parts list

TKN6835A Cable Transmitter (125 Watt) PL-4378-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle:
J8		Includes:
	14-82834H03	INSULATOR, 15-circuit
	29-82335A01	CONTACT, male; 15 req'd.
J900		Includes:
	15-10183A57	INSULATOR, 6-circuit
	29-82336A01	CONTACT, female; 6 req'd.
		mechanical parts
	29-8383C06	LUG, solderless; 2 req'd.
	42-10217A02	STRAP, cable harness

TRN4850A Chassis and Hardware Kit PL-8208-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C904	21-83289A03	1500 uF + 100-0%; 2500 V
		filter:
FL901, 902	91-87511C01	RFI
FL901	91-84013K02	low-pass
		connector & cable assy.:
J12	30-82904H01	single contact
		connector, plug:
P902	28-852527	male; single contact
P903	28-82398E02	male; single contact
		resistor, variable:
R900	18-82779L01	W.W. 300; 50 W
		switch, snap:
S1	40-82293F01	spst
		mechanical parts
	2-131435	NUT, 4-40 × 1/4 × 3/32"; 11 req'd.
	3-1437	SCREW, machine: 4-40 × 5/8"; 2 req'd.
	3-139012	SCREW, machine: 4-40 × 1/4"; 8 req'd.
	3-134186	SCREW, tapping: 6-32 × 5/16"; 8 req'd.
	3-135111	SCREW, tapping: 4-40 × 5/8"; 13 req'd.
	3-138162	SCREW, tapping: 4-40 × 3/8"; 6 used
	4-7670	LOCKWASHER, 1/4" internal; 4 used
	5-483208	GROMMET; 6 req'd.
	7-82040L01	FRAME, filter; 2 req'd.
	7-82075L01	BRACKET, connector mounting
	14-82311L01	INSULATOR, switch
	15-82038L01	HOUSING, filter; 2 req'd.
	15-82039L01	COVER, meter
	28-817985	CONNECTOR ADAPTER, right angle
	29-5293	LUG, soldering #4L
	29-824456	LUG, tongue
	35-82310L01	SCREEN, air; 2 req'd.
	36-82632H07	KNOB, control
	42-84284B01	RETAINER; 6 used
	42-10217A02	STRAP, cable harness
	42-82041L01	CLIP, filter mounting; 2 req'd.
	42-82143C02	CLAMP, cable
	43-82350N01	SPACER, box
	43-82351N01	SPACER; 4 used
	72-84865B06	METER
	72-84865B07	METER
	64-82306L01	PLATE, PA; mounting
	7-82074L01	MOUNTING, fan
	3-1819	SCREW, machine; 6-32 × 3/16"
	54-84119B01	LABEL WARNING
	75-82471N01	BUMPER NEO.; 4 used
	1-80708D74	HOUSING, PA terminal incl. ref. part FL901, 902
	15-82302L01	HOUSING, PA
	1-80708D75	COVER, PA terminal
	15-82355H01	CAP, tube (V901)
	15-82307L01	COVER, PA
	3-138162	SCREW, tapping; 4-40 × 3/8"
	3-82227A01	SCREW, special; 6 req'd.
	3-134293	SETSCREW; 10-32 × 1/4"
	30-84173E01	CABLE, coaxial: double-shielded; 11" req'd.

TRN6588A Control Logic Board PL-4381-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C903	21-82187B20	.001 uF ± 10%, 100 V
		transistor: (see note)
Q900	48-869729	NPN; type M9729
		resistor, fixed:
R901, 902	17-82177B29	75 ± 10%; 7 W
R903	6-126C35	270 ± 10%; 1 W
R904	6-124A73	10k ± 5%; 1/4 W
R905, 906	6-124C67	5.6k ± 10%; 1/4 W
		mechanical parts
	2-7005	NUT, 6-32 × 1/4 × 3/32"; 2 req'd.
	3-7229	SCREW, machine; 6-32 × 3/8"; 2 req'd.
	4-852212	WASHER, insulator; 2 req'd.
	4-7650	WASHER, #6; 2 req'd.

TRN6729A Blower Kit PL-4385-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		switch:
S2	40-82585L01	rotary, momentary
		mechanical parts
	3-136138	SCREW, tapping; 6-32 × 3/8"; 5 req'd.
	3-138806	SCREW, machine; 8-32 × 5/16"; 8 req'd.
	15-10183A56	INSULATOR, connector: 6-circuit
	29-82335A01	CONTACT, male; 6 req'd.
	42-83123F01	RETAINER, 5 req'd.
	59-82076L01	MOTOR, blower
	43-82548L01	SPACER
	3-8022	SCREW, machine; 4-40 × 1/4"
	3-136523	SCREW, machine; 4-40 × 7/8"; 2 used
	4-7667	LOCKWASHER #4 external; 3 req'd.
	15-84504M01	SHROUD
	35-84502M01	AIR VANE
	42-84501M01	SPRING CLIP
	64-84503M01	PLATE, switch mount

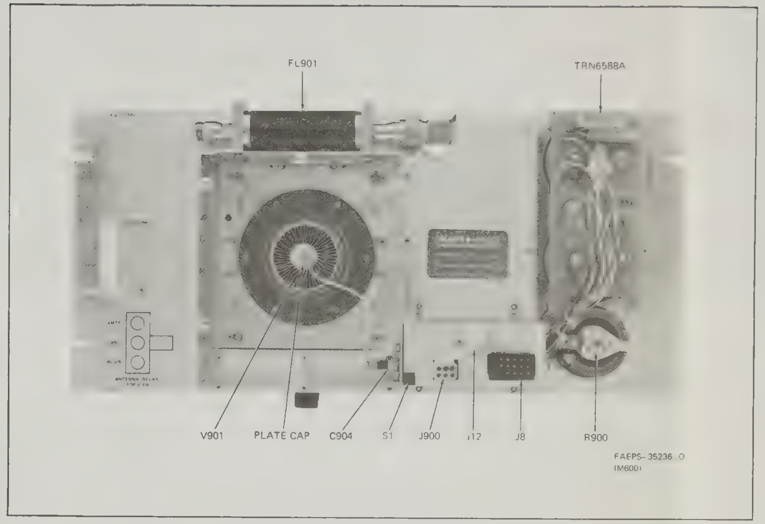
TLF6472A Amplifier Cavity PL-8213-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		cavity:
E901	1-82367N02	amplifier; assembly includes V901
		tube, electron:
V901	97-10794A01	3CX400U7/8961

TRN6572A Antenna Relay Kit (Base Station Only) PL-4434-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Field servicing of this unit is not recommended. Order entire unit for replacement.

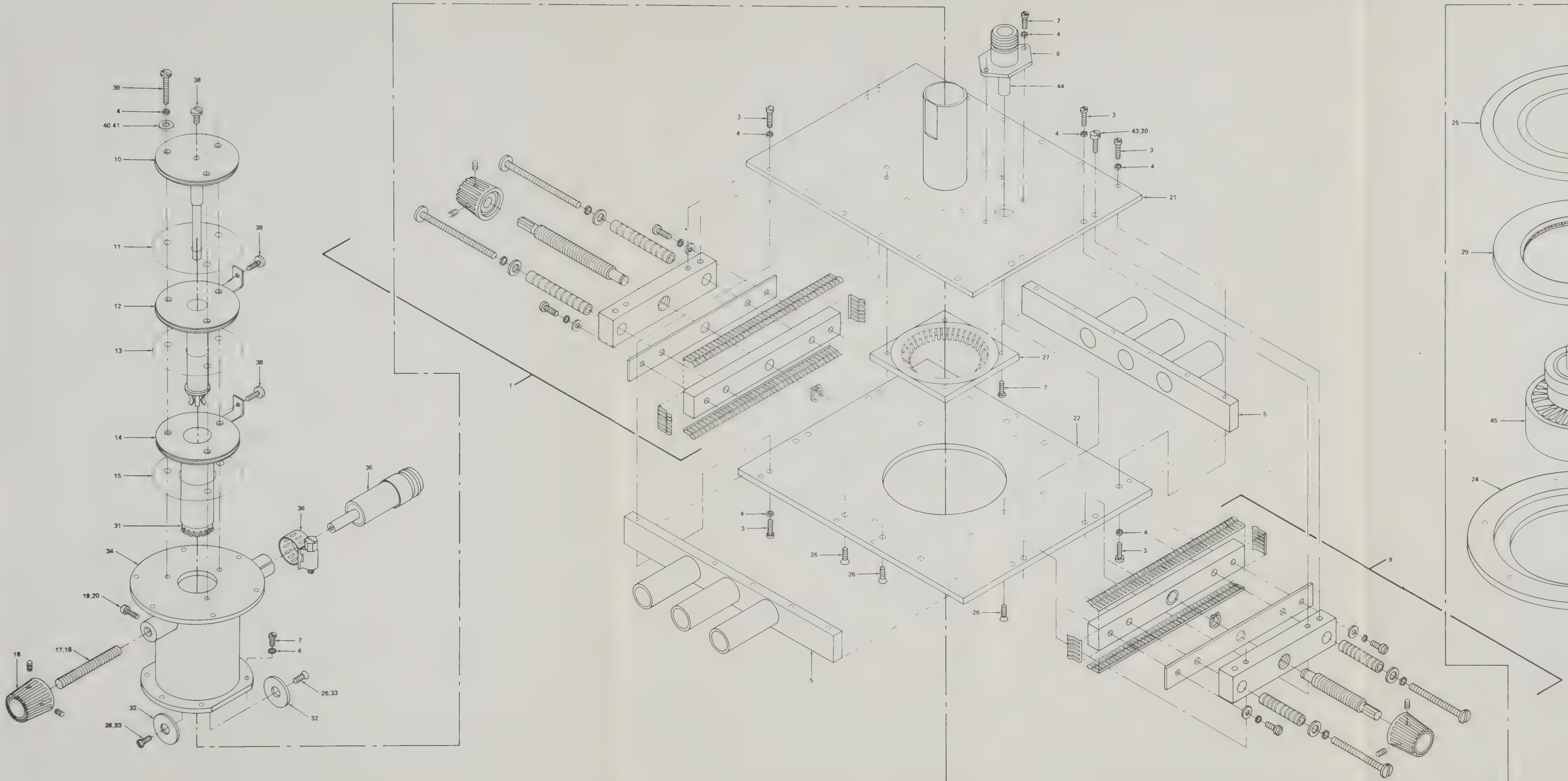
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



PA Rear View Component Identification

TLF1222A Final Power Amplifier Mechanical Parts List PL-8313-O

ITEM	MOTOROLA PART NO.	DESCRIPTION
1	1-82479N01	TUNING ASSY.-R.H.
2	54-82479N02	LABEL, tuning
3	—	SCREW, machine: 4-40 × 5/16"; 28 used
4	4-8442	LOCKWASHER, #4 split; 45 used
5	1-82479N03	SIDE BAR ASSY.; 2 used
6	54-82479N04	LABEL, output
7	3-1237	SCREW, machine: 4-40 × 1/4"; 12 used
8	1-82479N04	OUTPUT CONNECTOR ASSY.
9	1-82479N05	TUNING ASSY.-L.H.
10	39-82479N06	CONTACT ASSY., heater
11	14-82479N07	INSULATOR, inner heater (dielectric)
12	39-82479N08	CONTACT ASSY., outer heater
13	14-82479N09	INSULATOR, outer heater (dielectric)
14	38-82479N10	CONTACT ASSY., cathode collet
15	14-82479N11	INSULATOR, cathode (dielectric)
16	36-82479N12	KNOB, control
17	3-82479N13	SCREW, probe
18	11-82479N14	LUBRIPLATE (930 AA), as required
19	3-1587	SCREW, machine: 6-32 × 5/16"
20	4-82418B03	WASHER, insulating; 1/12 used
21	64-82479N15	GRID PANEL ASSY
22	64-82479N16	PANEL, anode
23	3-1534	SCREW, machine: 4-40 × 7/16"; 6 used
24	42-872479N17	CLAMP, ring-anode
25	14-82479N18	INSULATOR, anode (dielectric)
26	3-1938	SCREW, machine: 4-40 × 1/4"; 6 used
27	1-82479N19	GRID COLLET ASSY
28	14-82479N20	WASHER, insulating
29	1-82479N21	ANODE COLLET ASSY.
30	54-82479N22	LABEL, high voltage
31	42-82479N23	SPRING, cathode collet
32	49-82479N24	DISK, probe; 2 used
33	11-82479N25	LOCTITE, grade CV; as required
34	15-82479N26	HOUSING ASSY.
35	58-82479N27	SLIDING PROBE ASSY
36	42-82479N28	CLAMP, hose
37	54-82479N29	LABEL, coupling
38	3-8031	SCREW, machine: 6-32 × 1/4"; 3 used
39	3-1413	SCREW, machine: 4-40 × 5/8"; 3 used
40	4-114057	WASHER, flat: #4; 3 used
41	14-82479N30	INSULATOR, screen; 9 used
42	54-82479N31	LABEL, logo
43	3-7342	SCREW, machine: 6-32 × 3/8"; 4 used
44	11-82479N32	TAPE, kapton: 13/16" long
45	97-10794A01	TUBE, transmitting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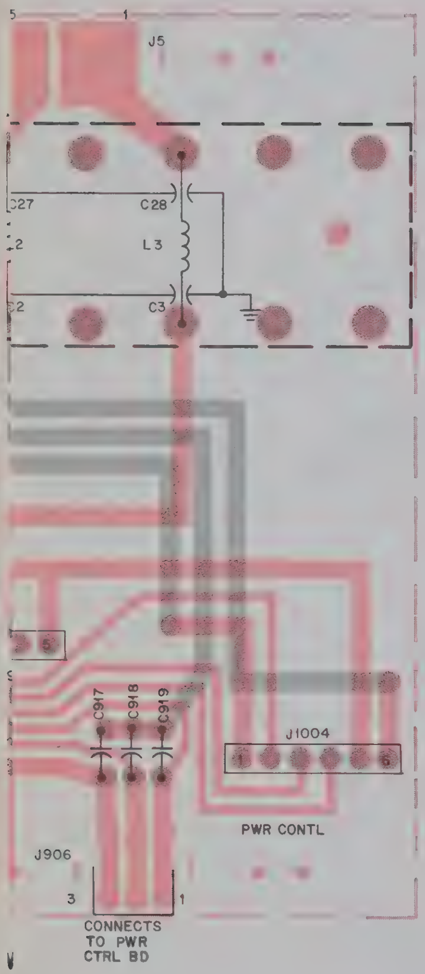
GEEPS–35173–O

TLF1222A Final Power Amplifier
Parts Location Detail
Motorola No. ***PEPS-35613-A***
1/26/84/UP

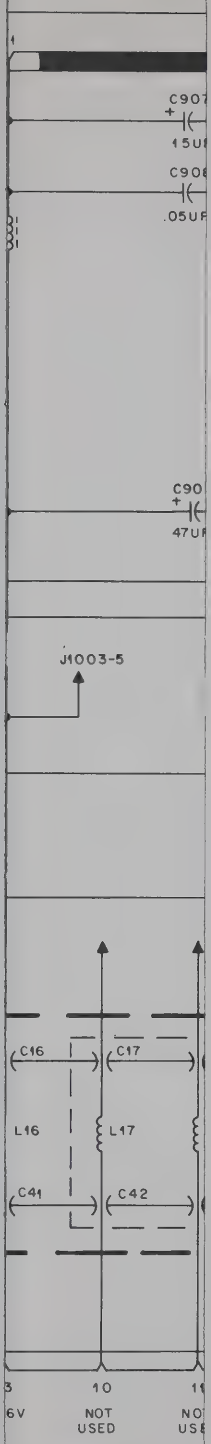


parts list

TRN5034A Transmitter Interconnect Board PL-8212-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1 thru 18	21-861219	1000 pF + 100-0%; 500 V
C19	21-82812H01	100 pF ± 10%; 500 V
C20 thru 43	21-861219	1000 pF + 100-0%; 500 V
C44 thru 50	21-82812H01	100 pF ± 10%; 500 V
C901 thru 904	21-82372C02	0.2 uF + 80-20%; 25 V
C905, 906	21-82372C04	0.05 uF + 80-20%; 25 V
C907	23-83214C02	15 pF ± 20%; 20 V
C908	21-82372C04	0.05 uF + 80-20%; 25 V
C909	23-82783B31	47 pF ± 20%; 20 V
C910	21-82372C04	0.05 uF + 80-20%; 25 V
C911, 912		NOT USED
C913, 914	21-82204B06	100 pF ± 10%; N1500
C915, 916		NOT USED
C917, 918, 919	21-82187B07	470 pF ± 10%; 500 V
C920	23-83214C20	10 uF ± 20%; 20 V
C921, 922	21-82372C04	0.05 uF + 80-20%; 25 V
		diode: (see note)
CR901, 902	48-82392B12	silicon
CR903	48-82466H13	silicon
		connector, receptacle:
J1000	28-83441F07	male, 6 pin, WHT
J1001	28-83441F06	male, 6 pin, RED
J1002	28-83441F04	male, 5 pin, RED
J1003	28-83441F05	male, 5 pin, WHT
J1004	28-83441F07	male, 6 pin, WHT
		coil, rf:
L1 thru 6	24-83977B01	1-1/2 turns
L7 thru 12	24-83961B01	3 turns
L13, 14	24-83977B01	1-1/2 turns
L15	24-83961B01	3 turns
L16	24-83977B01	1-1/2 turns
L17, 18	24-83961B01	3 turns
L19, 20	24-83977B01	1-1/2 turns
L21	24-83961B01	3 turns
L22	24-83977B01	1-1/2 turns
L23, 24	24-83961B01	3 turns
L25	24-83977B01	1-1/2 turns
L901 thru 904	24-80900A61	choke 0.62 uH
L905, 906, 907	24-83961B01	3 turns
L909	24-83961B01	3 turns
L908	24-854314	choke 33 uH
L910, 911	24-82723H01	choke, 1.2 uH
		transistor: (see note)
Q901	48-869640	type M9640
Q902	48-869701	type M9701
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R901	6-124C97	100k
R902 thru 905	6-124C73	10k
R906	6-124C49	1k
R908	17-82291B21	100 ± 5%; 3 W
R910	6-124A03	12 ± 5%
R911	6-124C49	1k
	non-referenced items	
	14-82621K01	INSULATOR
	3-134169	SCREW, tapping: 4-40 x 1/4" Phillips, hex head
	3-139495	SCREW, tapping: 4-40 x 5/16" Phillips; 4 used
	5-84220B01	GROMMET
	14-83375K01	INSULATOR
	42-83629G01	FASTENER, driver; 2 used
	1-80775B71	FILTER BRACKET ASSY.
	1-80775B75	FILTER BRACKET COVER
	14-82613M01	INSULATOR

note: Replacement diodes and transistors must be ordered by Motorola part number only for optimum perfomance.


C907
+
15U
C90
.05U
C90
+
47U
J1003-5
C16
C17
L16
L17
C41
C42
3
10
11
6V
NOT USED
NO
US

TRANSMITTER INTERCONNECT BOARD

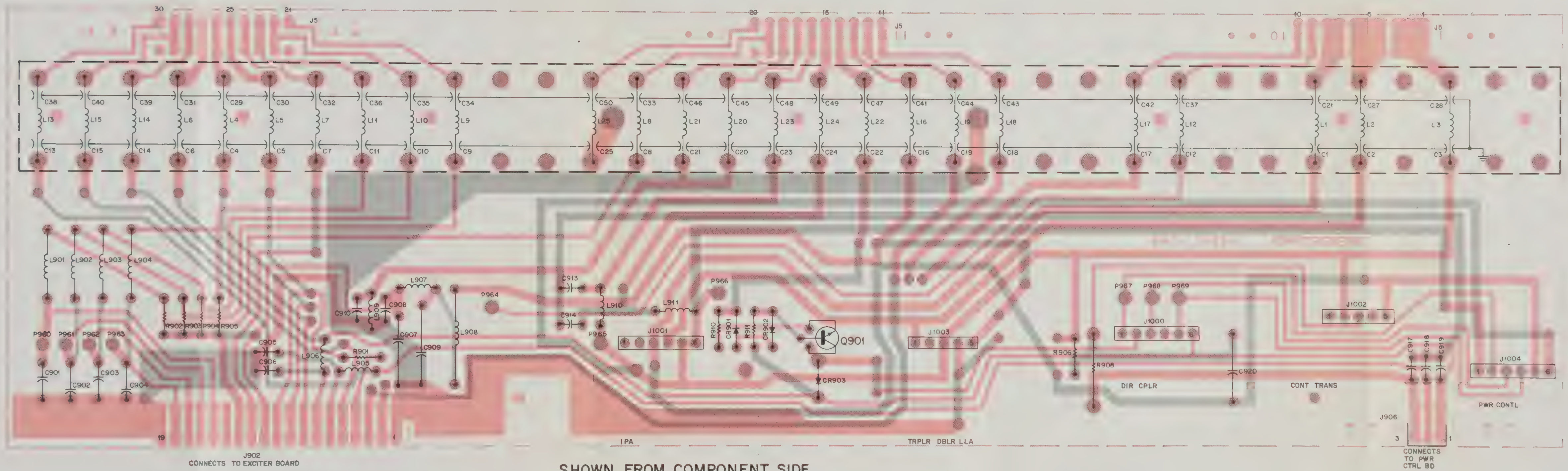
MODEL TRN5034A

FUNCTION

- Interconnects most transmitter circuit boards to each other (except PA).
- Routes control functions from the unified chassis interconnect board to the transmitter.
- Includes partial control stage circuitry used to govern PA power output.
- Includes current limiter stage which is electrically functional with antenna network.

TRANSMITTER INTERCONNECT BOARD
MODEL TRN5034A

J5 CONNECTS TO UNIFIED CHASSIS INTERCONNECT BD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J5
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J5
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5
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J5
C38
C40
C39
C31
C29
C30
C32
C36
C35
C34
C50
C33
C46
C45
C48
C49
C47
C41
C44
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C15
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C24
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C19
C18
C17
C12
C1
C2
C3
L901
L902
L903
L904
R902
R903
R904
R905
P960
P961
P962
P963
C901
C902
C903
C904
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L906
R901
L905
C910
L909
C908
L907
C907
C909
L908
P964
C913
C914
L910
P965
L911
J1001
P966
R910
CR901
R911
CR902
Q901
CR903
J1003
P967
P968
P969
J1000
R906
R908
C920
DIR CPLR
CONT TRANS
J1002
C917
C918
C919
J1004
PWR CONTL
J906
3
1
19
1
IPA
TRPLR DBLR LLA
J902
CONNECTS TO EXCITER BOARD
CONNECTS TO PWR CTRL BD

SHOWN FROM COMPONENT SIDE

SOLDER SIDE ⓢ BD-EEPS-35360-0
COMPONENT SIDE ⓒ BD-EEPS-35361-0
OL-EEPS-35362-0

parts list

TRN5034A Transmitter Interconnect Board PL-8212-O

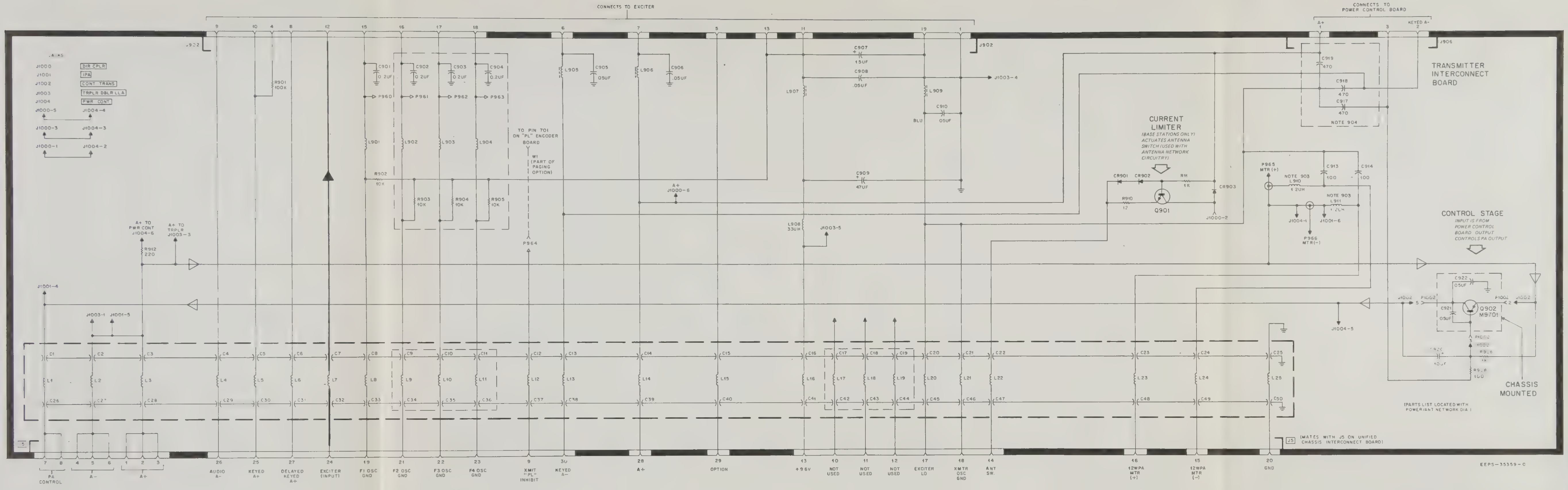
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1 thru 18	21-861219	1000 pF + 100-0%; 500 V
C19	21-82812H01	100 pF ± 10%; 500 V
C20 thru 43	21-861219	1000 pF + 100-0%; 500 V
C44 thru 50	21-82812H01	100 pF ± 10%; 500 V
C901 thru 904	21-82372C02	0.2 uF + 80-20%; 25 V
C905, 906	21-82372C04	0.05 uF + 80-20%; 25 V
C907	23-83214C02	15 pF ± 20%; 20 V
C908	21-82372C04	0.05 uF + 80-20%; 25 V
C909	23-82783B31	47 pF ± 20%; 20 V
C910	21-82372C04	0.05 uF + 80-20%; 25 V
C911, 912		NOT USED
C913, 914	21-82204B06	100 pF ± 10%; N1500
C915, 916		NOT USED
C917, 918, 919	21-82187B07	470 pF ± 10%; 500 V
C920	23-83214C20	10 uF ± 20%; 20 V
C921, 922	21-82372C04	0.05 uF + 80-20%; 25 V
		diode: (see note)
CR901, 902	48-82392B12	silicon
CR903	48-82466H13	silicon
		connector, receptacle:
J1000	28-83441F07	male, 6 pin, WHT
J1001	28-83441F06	male, 6 pin, RED
J1002	28-83441F04	male, 5 pin, RED
J1003	28-83441F05	male, 5 pin, WHT
J1004	28-83441F07	male, 6 pin, WHT
		coil, rf:
L1 thru 6	24-83977B01	1-1/2 turns
L7 thru 12	24-83961B01	3 turns
L13, 14	24-83977B01	1-1/2 turns
L15	24-83961B01	3 turns
L16	24-83977B01	1-1/2 turns
L17, 18	24-83961B01	3 turns
L19, 20	24-83977B01	1-1/2 turns
L21	24-83961B01	3 turns
L22	24-83977B01	1-1/2 turns
L23, 24	24-83961B01	3 turns
L25	24-83977B01	1-1/2 turns
L901 thru 904	24-80900A61	choke 0.62 uH
L905, 906, 907	24-83961B01	3 turns
L909	24-83961B01	3 turns
L908	24-854314	choke 33 uH
L910, 911	24-82723H01	choke, 1.2 uH
		transistor: (see note)
Q901	48-869640	type M9640
Q902	48-869701	type M9701
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R901	6-124C97	100k
R902 thru 905	6-124C73	10k
R906	6-124C49	1k
R908	17-82291B21	100 ± 5%; 3 W
R910	6-124A03	12 ± 5%
R911	6-124C49	1k
		non-referenced items
	14-82621K01	INSULATOR
	3-134169	SCREW, tapping: 4-40 x 1/4" Phillips, hex head
	3-139495	SCREW, tapping: 4-40 x 5/16" Phillips; 4 used
	5-84220B01	GROMMET
	14-83375K01	INSULATOR
	42-83629G01	FASTENER, driver; 2 used
	1-80775B71	FILTER BRACKET ASSY.
	1-80775B75	FILTER BRACKET COVER
	14-82613M01	INSULATOR

note: Replacement diodes and transistors must be ordered by Motorola part number only for optimum perfomance.

*Motorola No. **PEPS-35508-O***
(Sheet 1 of 2)
12/1/82- UP

TRANSMITTER INTERCONNECT BOARD

MODEL TRN5034A


CONNECTS TO EXCITER
CONNECTS TO POWER CONTROL BOARD
A+ 1
3
KEYED A- 2
J902
J906
TRANSMITTER INTERCONNECT BOARD
J1000 DIR CPLR
J1001 IPA
J1002 CONT TRANS
J1003 TRPLR DBLR LLA
J1004 PWR CONT
J1000-5 J1004-4
J1000-3 J1004-3
J1000-1 J1004-2
C919 470
C918 470
C917 470
NOTE 904
C907 15UF
C908 .05UF
L907
L909
C910 .05UF
BLU
C909 47UF
L908 33UH
J1003-5
J1003-4
R901 100K
C901 0.2UF
C902 0.2UF
C903 0.2UF
C904 0.2UF
P960
P961
P962
P963
L901
L902
L903
L904
R902 10K
R903 10K
R904 10K
R905 10K
TO PIN 701 ON "PL" ENCODER BOARD
W1 (PART OF PAGING OPTION)
P964
L905
C905 .05UF
L906
C906 .05UF
A+ J1000-6
CURRENT LIMITER
(BASE STATIONS ONLY) ACTUATES ANTENNA SWITCH (USED WITH ANTENNA NETWORK CIRCUITRY)
CR901
CR902
R11 1K
CR903
R910 12
Q901
J1000-2
P965 MTR (+)
NOTE 903 L910 1.2UH
C913 100
C914 100
NOTE 903 L911 1.2UH
J1004-1
J1001-6
P966 MTR (-)
CONTROL STAGE
INPUT IS FROM POWER CONTROL BOARD OUTPUT CONTROLS PA OUTPUT
C922 .05UF
C921 .05UF
Q902 M9701
J1002
P1002
J1004-5
CHASSIS MOUNTED
(PARTS LIST LOCATED WITH POWER/ANT NETWORK DIA.)
A+ TO PWR CONT J1004-6
A+ TO TRPLR J1003-3
R912 220
J1001-4
J1003-1
J1001-5
C1 … C50
L1 … L25
J5 (MATES WITH J5 ON UNIFIED CHASSIS INTERCONNECT BOARD)
7 8 PA CONTROL
4 5 6 A-
1 2 3 A+
26 AUDIO A-
25 KEYED A+
27 DELAYED KEYED A+
24 EXCITER (INPUT)
19 F1 OSC GND
21 F2 OSC GND
22 F3 OSC GND
23 F4 OSC GND
9 XMIT "PL" INHIBIT
30 KEYED A-
28 A+
29 OPTION
13 +9.6V
10 NOT USED
11 NOT USED
12 NOT USED
17 EXCITER LO
18 XMTR OSC GND
14 ANT SW.
16 12WPA MTR (+)
15 12WPA MTR (-)
20 GND
EEPS-35359-O

FUNCTION

- Interconnects most transmitter circuit boards to each other (except PA).
- Routes control functions from the unified chassis interconnect board to the transmitter.
- Includes partial control stage circuitry used to govern PA power output.
- Includes current limiter stage which is electrically functional with antenna network

NOTES

901 UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN PICOFARADS.

902 FILTERING CHOKES AND BYPASS CAPACITORS ARE USED ON VOLTAGE AND GROUND RUNS TO PREVENT RF RADIATION FROM BEING CONDUCTED TO THE UNIFIED CHASSIS INTERCONNECT BOARD AND AFFECTING STATION OPERATION

903 FILTERING CHOKES L910 AND L911 (FUNCTIONAL WITH 12 WATT STATIONS ONLY) PROVIDE FILTERING FOR BUILT IN STATION METERING.

904 CAPACITORS C917 C918 AND C919 SHUNT RF ENERGY ON THE A+ KEYED A AND POWER CONTROL LEADS TO GROUND

LEGEND

▷ = *THEORY OF OPERATION DATA*

▶ = *PRIMARY SIGNAL FLOW*

▷ = *SECONDARY SIGNAL FLOW*

Motorola No. PEPS-35508-O
(Sheet 2 of 2)
12 1/82- UP

MOTOROLA INC.

instruction manual revision

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81062E70-0	*PURC* Radio Paging Stations 928-960 MHz Transmit

REVISION DETAILS:

The TLN2675A (2-Frequency) and TLN2703A (3-Frequency) Multifrequency Control Modules are new units that have been added to the *PURC* station. Add the attached information to your *PURC* manual immediately following the Antenna Changeover Relay instruction section (PEPS-33548) behind the RECEIVER tab.

ATTACHMENTS:

Multifrequency Control Module
Instruction Section.................................68P81065E88-0

MOTOROLA INC.
Communications
Sector

MULTIFREQUENCY CONTROL MODULE

MODELS TLN2675A (2 FREQUENCY)
TLN2703A (3 FREQUENCY)

1. GENERAL DESCRIPTION

1.1 Multifrequency Control Modules TLN2675A (2 Frequency) and TLN2703A (3 Frequency) control the operating frequency of *PURC* Radio Paging Stations by selecting one of two or three paging synthesizers which are a part of the paging station. Motorola model number C75JZB1111A is a 2- frequency *PURC* radio paging station and model number C75-JZB1131A is a 3- frequency system.

1.2 The multifrequency control modules mount in standard 19-inch racks as shown in Figure 1. Table 1 shows the model complement for the multifrequency control modules. Interconnecting cabling data is given in PEPS-38154.

Table 1. Model Complement

Model	Description
TLN2675A	Multifrequency Control Module (2 Frequency)
TCN6264A	Control Board (2 Frequency)
TKN8989A	Cable Barrier Strip
TRN9039A	Chassis Hardware (2 Frequency)
TLN2703A	Multifrequency Control Module (3 Frequency)
TCN6265A	Control Board (3 Frequency)
TKN8989A	Cable Barrier Strip
TRN9127A	Chassis Hardware (3 Frequency)

1.3 RF is applied from two or three synthesizers to an rf switching network. Two frequency select signals from the simulcast control module, in conjunction with OUT-OF-LOCK INDICATE signals from the synthesizers, select which synthesizer is used. The selected synthesizer rf is applied to the exciter. The non-selected rf is attenuated by a PIN diode network.

1.4 Audio is routed from the exciter to the synthesizers. DEVIATION ADJUST potentiometers adjust the maximum deviation of each synthesizer.

2. THEORY OF OPERATION

(Refer to PEPS-38154 for schematic diagram details.)

The following description assumes a 3-frequency paging station. For a 2-frequency paging station, disregard all F3 or synthesizer 3 circuitry.

2.1 FREQUENCY SELECT AND RF SWITCHING CIRCUITRY

2.1.1 F1 SELECT (SYN 0) and F2 SELECT (SYN 1) from the simulcast control module enter at TB1-8 and TB1-9, respectively. These inputs are applied to logic network U4A, U6C, U2C, U2A, U6A, U2D, U3B, U6B, and U2B. In accordance with the truth table shown in Table 2, the output of U7B, U7C, or U7D goes high. This high turns on Q3, Q4, or Q5 causing the RF ENABLE to go low and turn on the selected synthesizer. (This condition assumes that the synthesizer is not out-of-lock as described in paragraph 2.2.)

Table 2. Synthesizer Select Truth Table

F1 Select (SYN 0)	F2 Select (SYN 1)	Synthesizer Selected
1	1	None (Station unkeyed.)
0	1	1 (U7B high)
1	0	2 (U7C high)
0	0	3 (U7D high)

2.1.2 The high from U7B, U7C, or U7D is also applied to rf switching PIN diode network CR2, CR3, CR5, CR6, CR8, and CR9 to select the desired synthesizer rf which is applied to the exciter via J4. The non-selected rf is attenuated by the PIN diode network. The PIN diode network provides an attenuation of 60 dB minimum. (Measured at 14 MHz with the output terminated into a 50 ohm spectrum analyzer and an input impedance of 50 ohms.)

2.1.3 The high from U7B, U7C, or U7D is also applied to Q6, Q7, or Q8 to turn on channel indicator LED DS1, DS2, or DS3.

2.1.4 Manual Select switch S1 is normally set to F1 which allows the frequency select circuitry to operate as described above. During servicing, any one of the three synthesizers can be selected by setting S1 to F1, F2, or F3 and by keying locally. When F2 or F3 are selected, DS4 flashes red on the front of the chassis to indicate that the unit is in a LOCAL F2 or LOCAL F3 servicing mode. Timer U1 determines the flashing rate of DS4.

2.2 OUT-OF-LOCK INDICATE CIRCUITRY

2.2.1 OUT-OF-LOCK INDICATE signals from the three synthesizers enter at TB1-2, TB1-3, and TB1-4. If any of the OUT-OF-LOCK INDICATE signals go low and the respective frequency is selected, Q1 turns on and the TRANSMIT INHIBIT at TB1-13 goes low to inhibit the transmitter.

2.2.2 Any low OUT-OF-LOCK INDICATE signal also turns on Q2 and relay K1 to provide a RELAY output which can be used to activate an out-of-lock alarm as desired.

2.2.3 Any low OUT-OF-LOCK INDICATE signal also turns off Q3, Q4, or Q5 (depending on which synthesizer is out-of-lock). This causes the RF ENABLE to go high and disable the respective synthesizer.

2.3 AUDIO CIRCUITRY

J5 receives audio from the exciter and applies the audio to DEVIATION ADJUST potentiometers R19, R20, and R21. The DEVIATION ADJUST potentiometers set the maximum deviation level of the audio applied to the synthesizers.

3. MULTIFREQUENCY TRANSMITTER ALIGNMENT

3.1 SYNTHESIZERS

Align each synthesizer per Paging Synthesizer instruction section 68P81062E72 *PURC* Radio Paging Stations Control and Application Manual 68P81060E70.

3.2 EXCITER

Align the exciter per instructions in Exciter instruction section 68P81063E18 in manual 68P81062E70 at the lowest transmitter frequency.

3.3 INTERMEDIATE POWER AMPLIFIER (IPA)

Align the IPA per instructions in IPA instruction section 68P81063E21 of manual 68P81062E70 at the lowest transmitter frequency.

3.4 FINAL POWER AMPLIFIER (FPA)

Align the FPA per instructions in FPA instruction section 68P81063E24 of manual 68P81062E70 at the lowest transmitter frequency. Then perform athe following procedure.

3.4.1 Multifrequency PA Tuning

Step 1. Note the power output level at the lowest frequency.

Step 2. Select the highest frequency and note the loss in power output level from Step 1.

Step 3. Turn the output tuning knob inward until 1/2 the loss noted in Step 2 is recovered.

Step 4. Select the lowest frequency and note any change in output power from Step 3.

Step 5. Turn the output tuning knob until 1/2 the loss in output power noted in Step 4 is recovered.

Step 6. Repeat Steps 1 through 5 until the difference in the power between the highest and lowest power is 2 watts or less.

Step 7. If there is a mid-frequency, select it. If output power is greater than 125 watts, reduce plate current to achieve 125 watts.

Step 8. Tighten down the output coupling and tuning controls. Tighten the input coupling shaft and tuning control.

3.4.2 Power Degradation for Multifrequency Stations

Adjust plate current control to achieve output power levels per table below.

Frequency Spacing	Radio Power Output
0 to 1-1/2 MHz	125 Watts
1-1/2 to 2-1/4 MHz	110 Watts

4. DEVIATION SETTING

To set maximum deviation, proceed as follows.

Step 1. Turn the exciter IDC control (R410) fully clockwise.

Step 2. Adjust the DEVIATION ADJUST controls, accessible through the front of the multifrequency control chassis, for ±5 kHz deviation. Do this for each frequency as shown below.

Frequency	Deviation Adjust (IDC) Control
F1	R19
F2	R20
F3	R21

5. JUMPER INFORMATION

5.1 MULTIFREQUENCY CONTROL MODULE TLN2675A AND TLN2703A

Jumpers are wired for either 2-frequency (TLN2675A) or 3-frequency (TLN2703A) operation as follows:

Jumper	2-Frequency	3-Frequency
JU1	OUT	OUT
JU2	IN	IN
JU3	OUT	IN

5.2 SIMULCAST CONTROL MODULE TLN2559B

JU2 is IN for single frequency operation and OUT for multifrequency operations.

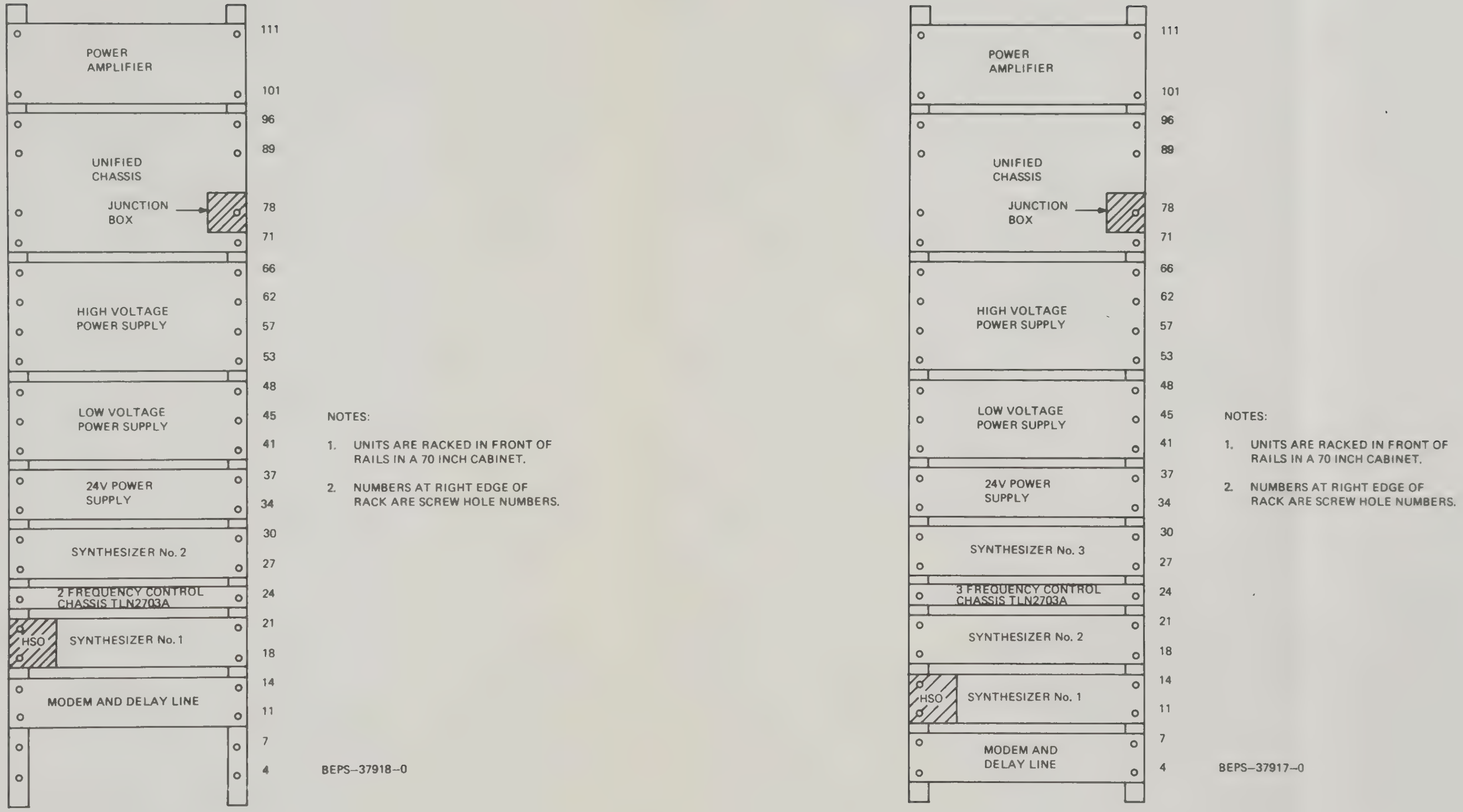
5.3 STATION CONTROL MODULE TRN4854B

JU4 is IN for multifrequency operation. JU4 is OUT for single frequency operation when using a TLN2559B Simulcast Control Module. JU4 is IN for single frequency operation when using a TLN2559A Simulcast Control Module.

RE RACKED IN FRONT OF
A 70 INCH CABINET.

S AT RIGHT EDGE OF
RE SCREW HOLE NUMBERS.

Figure 1. PURC Radio Paging Station Rack Layout


POWER AMPLIFIER
UNIFIED CHASSIS
JUNCTION BOX
HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY
24V POWER SUPPLY
SYNTHESIZER No. 2
2 FREQUENCY CONTROL CHASSIS TLN2703A
HSO
SYNTHESIZER No. 1
MODEM AND DELAY LINE
111
101
96
89
78
71
66
62
57
53
48
45
41
37
34
30
27
24
21
18
14
11
7
4
POWER AMPLIFIER
UNIFIED CHASSIS
JUNCTION BOX
HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY
24V POWER SUPPLY
SYNTHESIZER No. 3
3 FREQUENCY CONTROL CHASSIS TLN2703A
SYNTHESIZER No. 2
HSO
SYNTHESIZER No. 1
MODEM AND DELAY LINE

NOTES:

1. UNITS ARE RACKED IN FRONT OF RAILS IN A 70 INCH CABINET.
2. NUMBERS AT RIGHT EDGE OF RACK ARE SCREW HOLE NUMBERS.

BEPS–37918–0

2 FREQUENCY LAYOUT

NOTES:

1. UNITS ARE RACKED IN FRONT OF RAILS IN A 70 INCH CABINET.
2. NUMBERS AT RIGHT EDGE OF RACK ARE SCREW HOLE NUMBERS.

BEPS–37917–0

3 FREQUENCY LAYOUT

Figure 1. PURC Radio Paging Station Rack Layout

MULTIFREQUENCY CONTROL MODULE

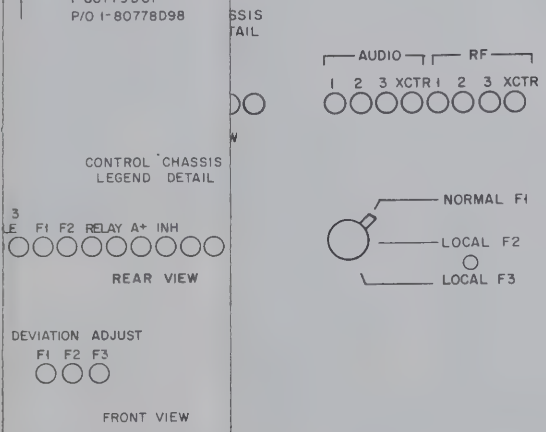
MODELS TLN2675A (2 FREQUENCY)
TLN2703A (3 FREQUENCY)

TERCONNECTING

ART NUMBERS FOR THE INTERC
S FOLLOWS.

PART NO.

1-80759D83
1-80759D84
1-80778D97
1-80778D99
NOT USED
1-80779D01
P/O 1-80778D98

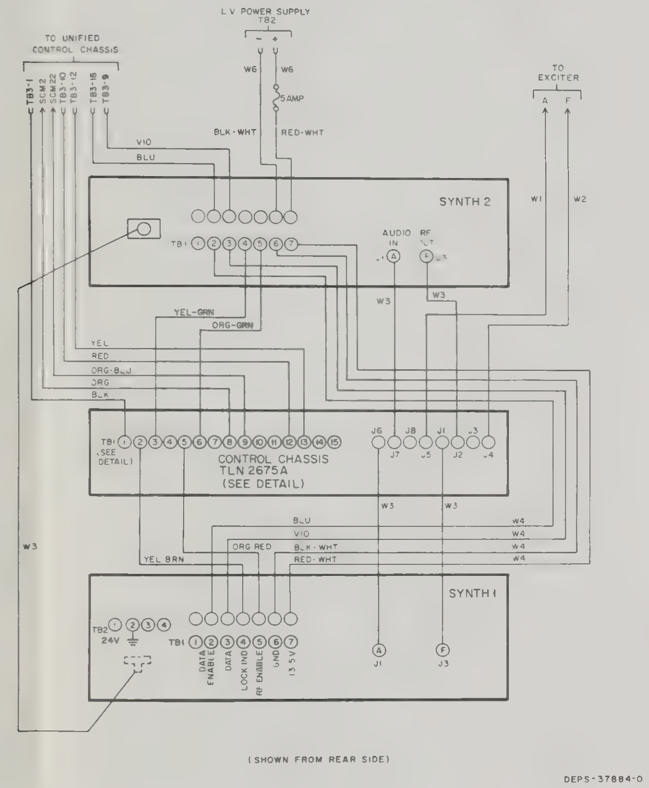

SSIS
TAIL
AUDIO
RF
1 2 3 XCTR 1 2 3 XCTR
W
CONTROL CHASSIS
LEGEND DETAIL
NORMAL F1
LOCAL F2
LOCAL F3
3
LE F1 F2 RELAY A+ INH
REAR VIEW
DEVIATION ADJUST
F1 F2 F3
FRONT VIEW

MULTIFREQUENCY CONTROL MODULE

Motorola No. PEPS-38154-O
(Sheet 1 of 3)
11/11/83- UP

MULTIFREQUENCY CONTROL MODULE

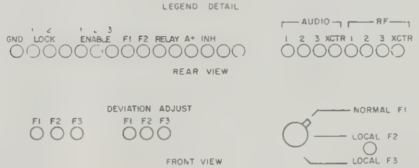
MODELS TLN2675A (2 FREQUENCY)
TLN2703A (3 FREQUENCY)


TO UNIFIED CONTROL CHASSIS
TB3-1
SCM2
SCM22
TB3-10
TB3-12
TB3-16
TB3-9
L V POWER SUPPLY TB2
– +
W6
W6
5AMP
BLK-WHT
RED-WHT
TO EXCITER
A
F
W1
W2
VIO
BLU
SYNTH 2
TB1 1 2 3 4 5 6 7
AUDIO IN
RF OUT
J1
J3
W3
W3
YEL-GRN
ORG-GRN
YEL
RED
ORG-BLU
ORG
BLK
TB1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
(SEE DETAIL)
CONTROL CHASSIS
TLN 2675A
(SEE DETAIL)
J6
J7
J8
J5
J1
J2
J3
J4
W3
W3
W3
BLU
VIO
ORG RED
BLK-WHT
RED-WHT
YEL BRN
W4
W4
W4
W4
SYNTH 1
TB2 1 2 3 4
24V
TB1 1 2 3 4 5 6 7
DATA ENABLE
DATA
LOCK IND
RF ENABLE
GND
13.5V
A
F
J1
J3
(SHOWN FROM REAR SIDE)
DEPS-37884-0

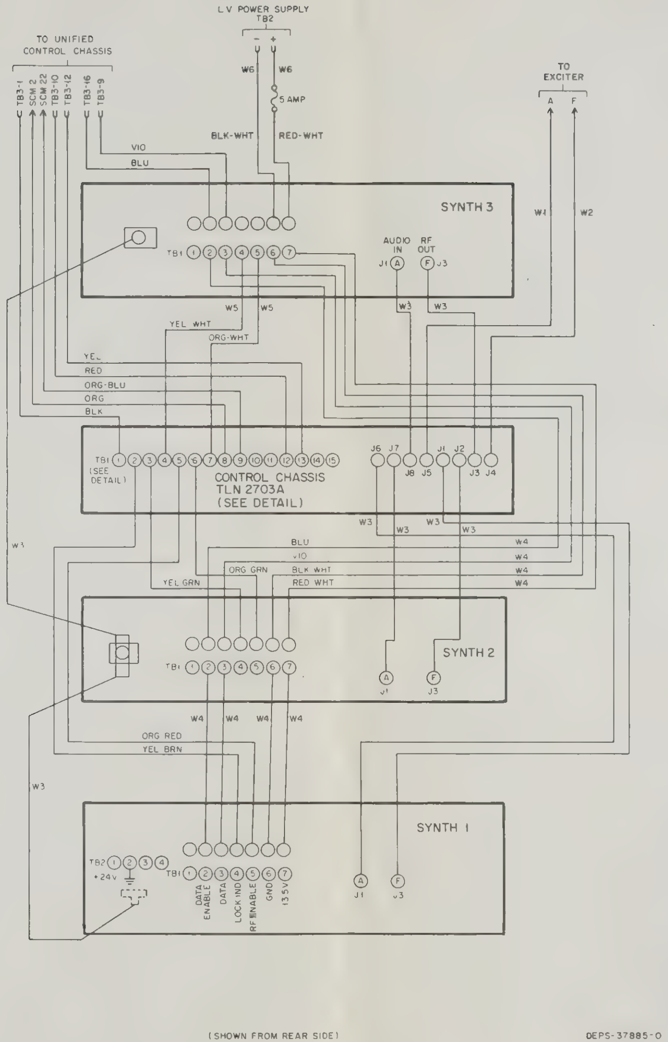
NOTE
MOTOROLA PART NUMBERS FOR THE INTERCONNECTING CABLING IS AS FOLLOWS

REFERENCE DESIGNATION	PART NO
W1	1-80759D83
W2	1-80759D84
W3	1-80778D97
W4	1-80778D99
W5	NOT USED
W6	1-80779D01
—	P/O 1-80778D98

CONTROL CHASSIS LEGEND DETAIL


1 2
GND
LOCK
1 2 3
ENABLE
F1
F2
RELAY
A+
INH
AUDIO
1 2 3 XCTR
RF
1 2 3 XCTR
REAR VIEW
DEVIATION ADJUST
F1 F2 F3
F1 F2 F3
FRONT VIEW
NORMAL F1
LOCAL F2
LOCAL F3

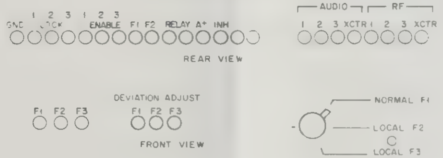
2-FREQUENCY INTERCONNECTING CABLING


TO UNIFIED CONTROL CHASSIS
TB3-1
SCM 2
SCM 22
TB3-10
TB3-12
TB3-16
TB3-9
L.V. POWER SUPPLY TB2
– +
W6
W6
5 AMP
BLK-WHT
RED-WHT
TO EXCITER
A
F
W1
W2
VIO
BLU
SYNTH 3
TB1 1 2 3 4 5 6 7
AUDIO IN
RF OUT
J1
J3
W5
W5
W3
W3
YEL-WHT
ORG-WHT
YEL
RED
ORG-BLU
ORG
BLK
TB1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
(SEE DETAIL)
CONTROL CHASSIS
TLN 2703A
(SEE DETAIL)
J6
J7
J8
J5
J1
J2
J3
J4
W3
W3
W3
W3
BLU
VIO
ORG GRN
BLK-WHT
RED-WHT
YEL GRN
W4
W4
W4
W4
W1
SYNTH 2
TB1 1 2 3 4 5 6 7
J1
J3
W4
W4
W4
W4
ORG RED
YEL BRN
W3
SYNTH 1
TB2 1 2 3 4
+24V
TB1 1 2 3 4 5 6 7
DATA ENABLE
DATA
LOCK IND
RF ENABLE
GND
13.5V
J1
J3
(SHOWN FROM REAR SIDE)
DEPS-37885-0

NOTE
MOTOROLA PART NUMBERS FOR THE INTERCONNECTING CABLING IS AS FOLLOWS

REFERENCE DESIGNATION	PART NO
W1	1-80759D83
W2	1-80759D84
W3	1-80778D97
W4	1-80778D99
W5	1-80781D31
W6	1-80779D01
—	P/O 1-80778D98

CONTROL CHASSIS LEGEND DETAIL


1 2 3
GND
LOCK
1 2 3
ENABLE
F1
F2
RELAY
A+
INH
AUDIO
1 2 3 XCTR
RF
1 2 3 XCTR
REAR VIEW
DEVIATION ADJUST
F1 F2 F3
F1 F2 F3
FRONT VIEW
NORMAL F1
LOCAL F2
LOCAL F3

3-FREQUENCY INTERCONNECTING CABLING

parts list

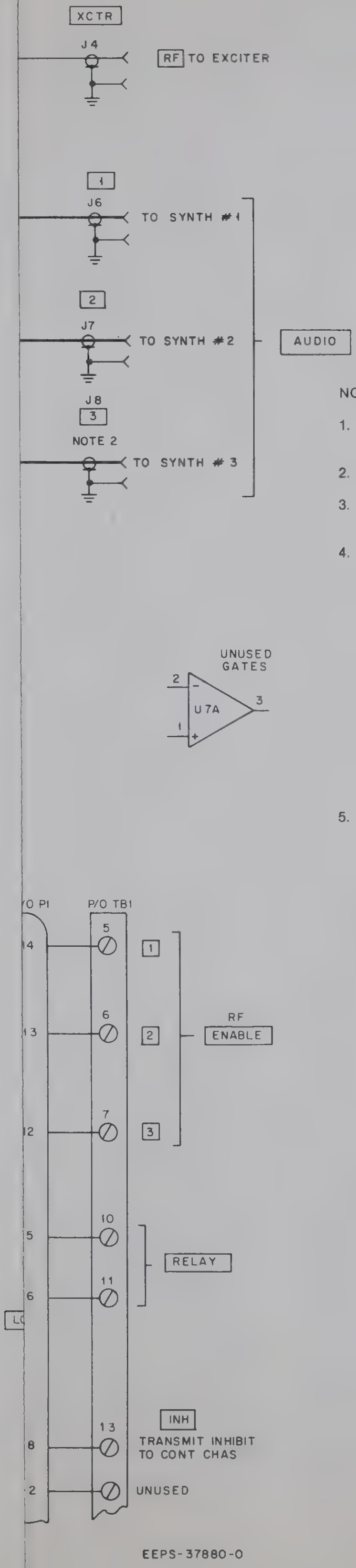
TCN6264A Control Board (2-Frequency)
TCN6265A Control Board (3-Frequency) PL-8688-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed; uF:
C1 thru 5	21-11015A07	.01 +80 – 20%
C6		NOT USED
C7, 8	21-11015A07	.01 +80 – 20%
C9		NOT USED
C10	23-84538G06	47 ± 20%; 20 V
C11	23-84538G04	15 ± 20%; 20 V
C12	21-11015A07	.01 +80 – 20%
		diode: (see note)
CR1		NOT USED
CR2, 3	48-83510F03	silicon
CR4		NOT USED
CR5, 6	48-83510F03	silicon
CR7		NOT USED
CR8, 9	48-83510F03	silicon
CR10, 11	48-83654H01	silicon
CR12	48-82466H13	silicon
		light emitting diode: (see note)
DS1 thru 3	48-88245C29	green
DS4	48-88245C28	red
		connector:
J1 thru 8	29-80014A01	TERMINAL, coaxial cable
		relay:
K1	80-82617M11	1 form "C"; coil res. 800
		coil, rf:
L1 thru 5	24-82135G10	choke; 100 uH
		connector, plug:
P1	28-83143M03	male; 14-contact
		transistor: (see note)
Q1 thru 8	48-869642	NPN: type M9642
		resistor, fixed ±; 1/4 W: unless otherwise stated
R1, 2		NOT USED
R3, 4	6-11009C49	1k
R5, 6	6-11009C43	560
R7, 8		NOT USED
R9, 10	6-11009C49	1k
R11 thru 14		NOT USED
R15, 16	6-11009C49	1k
R17, 18		NOT USED
R19, 20, 21	18-83452F19	variable; 100k
R22	6-125B70	1; 1/2 W
R23	6-11009C65	4.7k
R24	6-11009C69	6.8k
R25	6-11009C81	22k
R26	6-11009C65	4.7k
R27	6-11009C47	820
R28	6-11009C49	1k
R29	6-11009C47	820
R30	6-11009C49	1k
R31	6-11009C47	820
R32	6-11009C49	1k
R33	6-11009C47	820
R34 thru 38	6-11009C65	4.7k
R39, 40, 41	6-11009C61	3.3k
R42	6-11009C49	1k
R43	6-11009C37	330
R44	6-11009C49	1k
R45	6-11009C37	330
R46	6-11009C65	4.7k
R47, 48	6-11009C49	1k
R49, 50, 51	6-11009C73	10k
		switch:
S1	40-83658N01	rotary; 5 position
		integrated circuit: (see note)
U1	51-84561L23	timer
U2, 3	51-82884L04	quad 2-input NOR gate
U4	51-82884L17	triple 3-input NOR gate
U5, 6	51-82884L02	hex non-inverting buffer
U7	51-83629M08	quad operational amplifier
	mechanical parts	
	3-138162	SCREW, tapping: 4-40 × 3/8"; 6 used
	42-84284B01	RETAINER; 6 used
	1-80778D92	CABLE Assembly, short; 2 used TCN6264A, 3 used TCN6265A; includes:
	9-84968D01	CONNECTOR, female; single contact
	30-83794C01	CABLE, coaxial (WHT) 6"
	1-80778D93	CABLE Assembly, long; 4 used TCN6264A, 5 used TCN6265A; includes:
	9-84968D01	CONNECTOR, female; single contact
	30-83794C01	CABLE, coaxial (WHT); 8-1/2"

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

MULTIFREQUENCY CONTROL MODULE

MODELS TLN2675A (2 FREQUENCY)
TLN2703A (3 FREQUENCY)


XCTR
J4
RF TO EXCITER
1
J6
TO SYNTH #1
2
J7
TO SYNTH #2
AUDIO
J8
3
NOTE 2
TO SYNTH # 3
UNUSED GATES
2
1
U7A
3
P/O P1
P/O TB1
14
5
13
6
12
7
1
2
3
RF ENABLE
5
10
6
11
RELAY
8
13
INH
TRANSMIT INHIBIT TO CONT CHAS
2
UNUSED
EEPS-37880-O

NOTES:

1. Unless otherwise specified, all resistors are in ohms; all capacitors are in microfarads; and all inductors are in microhenries.
2. J3 and J8 are installed in TCN6265A Models only.
3. DS4 flashes when S1 selects LOCAL F2 or LOCAL F3. DS4 is off when S1 selects normal F1.
4. Integrated circuit connections for this board are as follows:

Reference Designation	Mfgr's Description	A+	GND
U1	Timer	8	1
U2, U3	Quad 2-Input NOR Gate	14	7
U4	Triple 3-Input NOR Gate	14	7
U5, U6	Hex Inverter Buffer	1	8
U7	Quad Op Amp	4	11

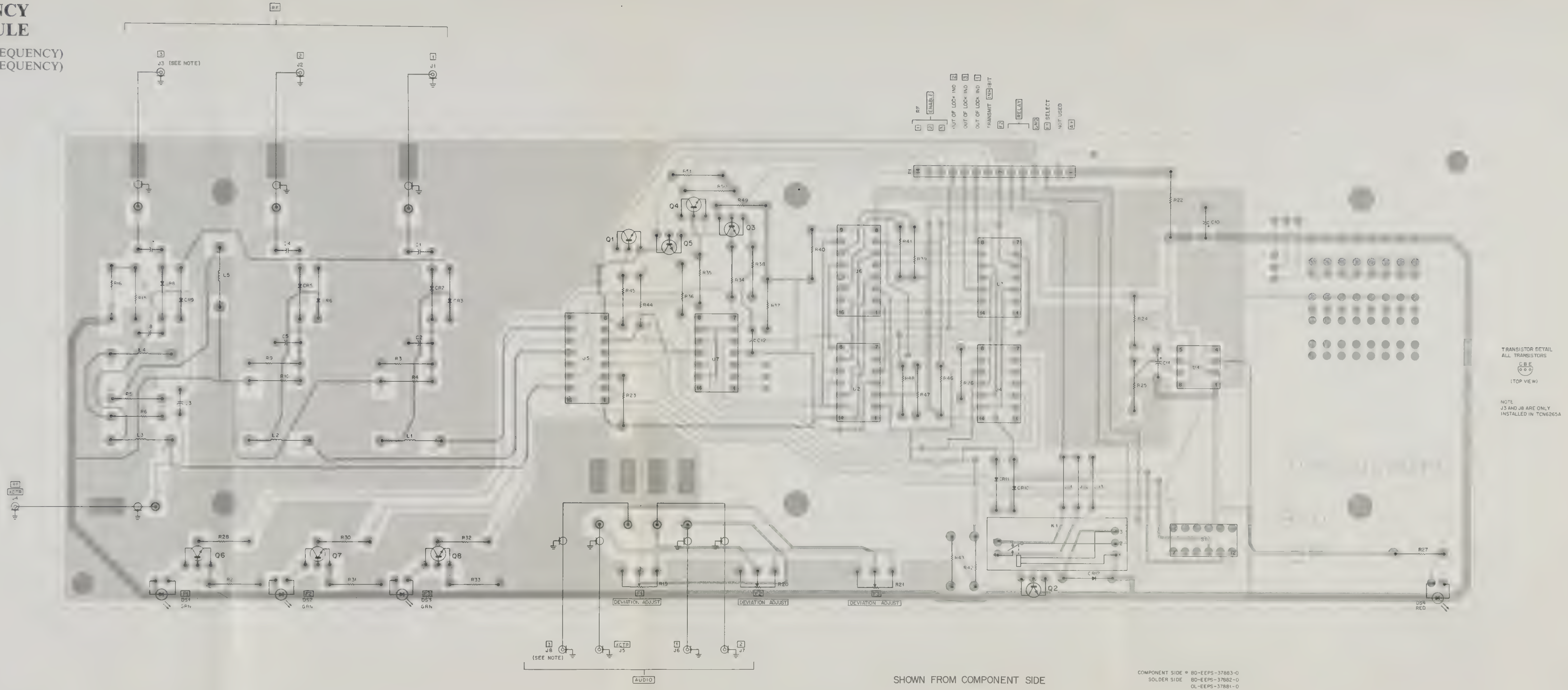
5. Jumpers are wired for either 2-frequency or 3-frequency operation as follows:

Jumper	2-Frequency	3-Frequency
JU1	OUT	OUT
JU2	IN	IN
JU3	OUT	IN

Motorola No. PEPS-38154-O
(Sheet 3 of 3)
11/11/83- UP

MULTIFREQUENCY CONTROL MODULE

MODELS TLN2675A (2 FREQUENCY)
TLN2703A (3 FREQUENCY)


RF
J3 (SEE NOTE)
J2
J1
ENABLE
1
2
3
OUT OF LOCK IND 2
OUT OF LOCK IND 3
OUT OF LOCK IND 1
TRANSMIT INHIBIT
F2
RELAY
GND
F1 SELECT
NOT USED
A+
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
U1
U2
U3
U4
U5
U6
U7
K1
S1
L1
L2
L3
L4
L5
R22
R27
DS1 GRN
DS2 GRN
DS3 GRN
DS4 RED
DEVIATION ADJUST
DEVIATION ADJUST
DEVIATION ADJUST
J8 (SEE NOTE)
J6
J7
AUDIO
TRANSISTOR DETAIL
ALL TRANSISTORS
C B E
(TOP VIEW)

NOTE
J3 AND J8 ARE ONLY
INSTALLED IN TCN6265A

SHOWN FROM COMPONENT SIDE

COMPONENT SIDE ● BD-EEPS-37883-O
SOLDER SIDE BD-EEPS-37882-O
OL-EEPS-37881-O

Motorola No. PEPS-38154-O
(Sheet 2 of 3)
11/11/83- UP

parts list

TCN6264A Control Board (2-Frequency)
TCN6265A Control Board (3-Frequency)
PL 8688-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed; uF
C1 thru 5	21-11015A07	.01 + 80 – 20%
C6		NOT USED
C7, 8	21-11015A07	.01 + 80 – 20%
C9		NOT USED
C10	23-84538G06	47 ± 20%, 20 V
C11	23-84538G04	15 ± 20%, 20 V
C12	21-11015A07	.01 + 80 – 20%
		diode (see note)
CR1		NOT USED
CR2, 3	48-83510F03	silicon
CR4		NOT USED
CR5, 6	48-83510F03	silicon
CR7		NOT USED
CR8, 9	48-83510F03	silicon
CR10, 11	48-83654H01	silicon
CR12	48-82466H13	silicon
		light emitting diode (see note)
DS1 thru 3	48-88245C29	green
DS4	48-88245C28	red
		connector
J1 thru 8	29-80014A01	TERMINAL, coaxial cable
		relay
K1	80-82617M11	1 form "C", coil res 800
		coil, rf
L1 thru 5	24-82135G10	choke, 100 uH
		connector, plug
P1	28-83143M03	male, 14-contact
		transistor (see note)
Q1 thru 8	48-869642	NPN type M9642
		resistor fixed ±, 1/4 W unless otherwise stated
R1, 2		NOT USED
R3, 4	6-11009C49	1k
R5, 6	6-11009C43	560
R7, 8		NOT USED
R9, 10	6-11009C49	1k
R11 thru 14		NOT USED
R15, 16	6-11009C49	1k
R17, 18		NOT USED
R19, 20, 21	18-83452F19	variable, 100k
R22	6-125B70	1, 1/2 W
R23	6-11009C65	4.7k
R24	6-11009C69	6.8k
R25	6-11009C81	22k
R26	6-11009C65	4.7k
R27	6-11009C47	820
R28	6-11009C49	1k
R29	6-11009C47	820
R30	6-11009C49	1k
R31	6-11009C47	820
R32	6-11009C49	1k
R33	6-11009C47	820
R34 thru 38	6-11009C65	4.7k
R39, 40, 41	6-11009C61	3.3k
R42	6-11009C49	1k
R43	6-11009C37	330
R44	6-11009C49	1k
R45	6-11009C37	330
R46	6-11009C65	4.7k
R47, 48	6-11009C49	1k
R49, 50, 51	6-11009C73	10k
		switch
S1	40-83658N01	rotary, 5 position
		integrated circuit (see note)
U1	51-84561L23	timer
U2, 3	51-82884L04	quad 2-input NOR gate
U4	51-82884L17	triple 3-input NOR gate
U5, 6	51-82884L02	hex non-inverting buffer
U7	51-83629M08	quad operational amplifier
		mechanical parts
	3-138162	SCREW, tapping 4-40 × 3/8", 6 used
	42-84284B01	RETAINER, 6 used
	1-80778D92	CABLE Assembly short, 2 used TCN6264A 3 used TCN6265A includes
	9-84968D01	CONNECTOR, female, single contact
	30-83794C01	CABLE, coaxial (WHT) 6"
	1-80778D93	CABLE Assembly, long, 4 used TCN6264A 5 used TCN6265A, includes
	9-84968D01	CONNECTOR, female, single contact
	30-83794C01	CABLE, coaxial (WHT), 8-1/2"

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers

parts list

TKN8955A Assembly Cable (2-Frequency)
TKN8999A Assembly Cable (3-Frequency) PL-8778-O

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		cable
W1	1-80759D83	AUDIO CABLE Assembly, includes
	28-83099K01	CONNECTOR male single contact, 2 used
	30-83794C01	CABLE, coaxial (WHT), 60" used
	37-82603D88	SLEEVING, coded "A" 2 used
W2	1-80759D84	RF CABLE Assembly, includes
	28-83099K01	CONNECTOR male single contact, 2 used
	30-83794C01	CABLE, coaxial (WHT), 60" used
	37-82603D93	SLEEVING coded "F", 2 used
W3	1-80778D97	CABLE (12") Assembly, includes
	28-83099K01	CONNECTOR, male single contact, 2 used
	30-83794C01	CABLE, coaxial (WHT), 12" used
W4	1-80778D99	CABLE Assembly interconnect, includes
	29-812979	LUG, crimp terminal 8 used
	42-10217A02	STRAP tie 091 × 3.62" (WHT), 5 used
W5	1-80781D31	CABLE Assembly interconnect, 3-Freq., includes
	29-812979	lug crimp terminal, 4 used
	42-10217A02	STRAP, tie 091 × 3.62" (WHT), 4 used
W6	1-80779D01	CABLE Assembly, fused includes
	14-82882A01	BODY, fuseholder
	14-82883A01	CAP fuseholder
	41-82885A01	SPRING fuseholder
	29-812979	LUG crimp terminal, 4 used
	42-10217A02	STRAP tie 091 × 3.62" (WHT), 4 used
	42-82884A01	CLIP fuse, 2 used
	65-52293	FUSE, 5 amp, 250 V
	1-80778D98	CABLE Assembly, control, includes
	9-83012H02	RECEPTACLE, crimp, 2 used
	29-812979	LUG crimp terminal, 20 used
	37-82603D60	SLEEVING coded blank, 2 used
	42-10217A02	STRAP tie 091 × 3.62" (WHT), 20 used

TRN9176A Hardware Kit (3-Frequency) PL-8776-O

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
	2-82360B34	NUT speed 1/4-14 6 used
	3-135038	SCREW, tapping 14-14 × 3/4", 6 used
	9-82578B01	CONNECTOR "T"
	47-82977P01	ROD slide synthesizer, 2 used
	54-83261P01	LABEL, channel and frequency

TKN8214A Modem Cable
TKN8998A 60" Modem Cable PL-8775-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1-80781D30	MODEM CABLE Assembly 60" (TKN8998A) includes
	14-84520E01	HOOD, connector
	28-84506E01	CONNECTOR, male: 25 contact
	29-812979	LUG, crimp terminal; 4 used
	29-84078B01	LUG, flanged spade
	42-10217A02	STRAP, tie 091 × 3.62" (WHT), 11 used
	1-80742D35	MODEM CABLE Assembly (TKN8214A) includes
	14-84502E01	HOOD, connector
	28-84506E01	CONNECTOR, male, 25-contact
	29-812979	LUG, crimp terminal; 4 used
	29-84078B01	LUG, flanged spade
	42-10217A02	STRAP, tie 091 × 3.62 (WHT); 10 used

TRN5980A Hardware Multifrequency PL-8777-O

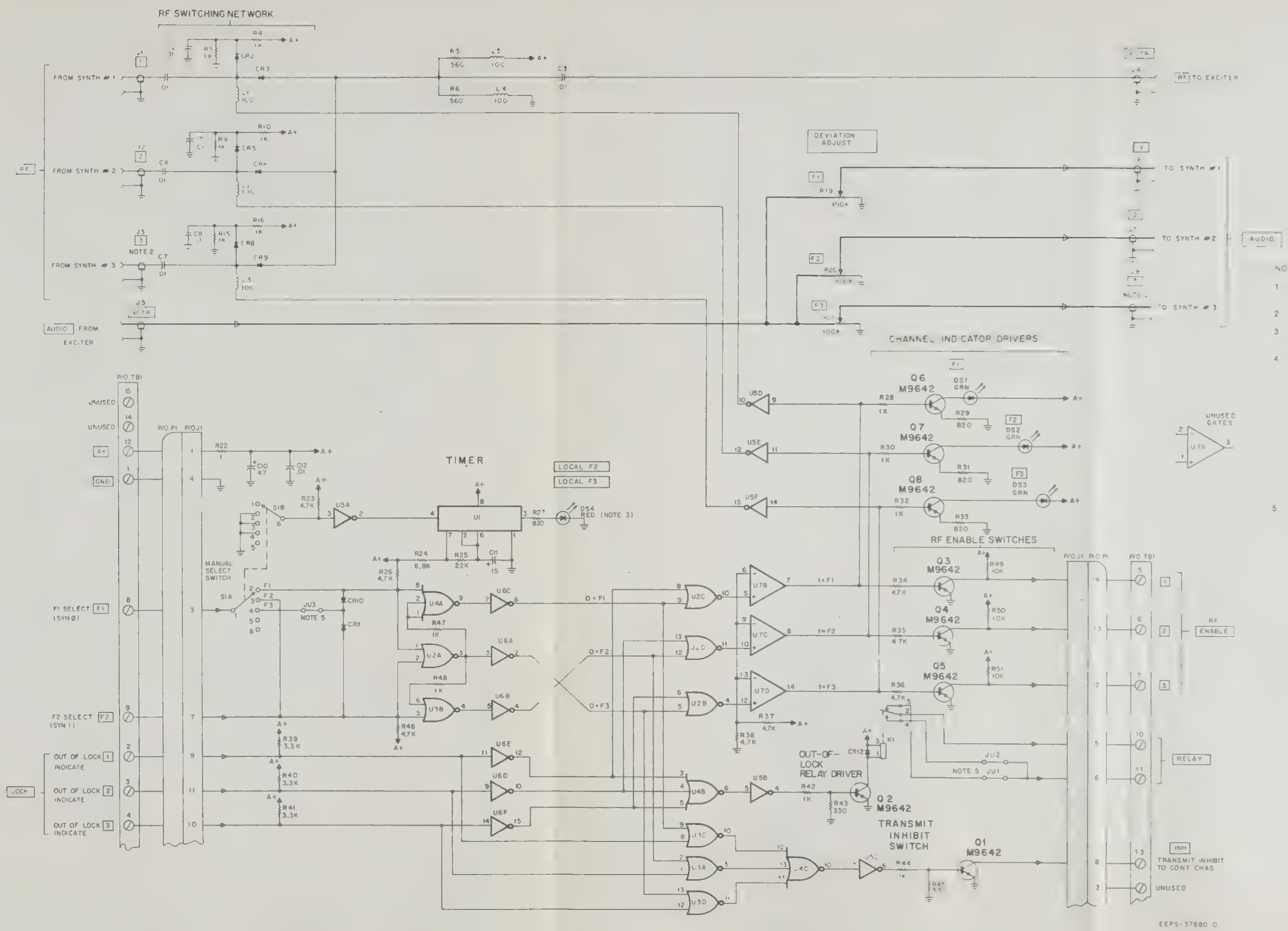
REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
	3-138162	SCREW, tapping 4-40 × 3/8"; 2 used
	42-84284B01	RETAINER, 2 used
	75-82303N04	PAD, rubber
	5-84500B03	EYELET, special; 2 used
	15-83537N02	COVER, channel element
	1-80769D84	EXCITER CABLE Assembly includes
	9-83208C02	SOCKET
	9-84968D01	CONNECTOR, female, single contact (BNC); 2 used
	26-82254P01	SHIELD, oscillator
	30-83794C01	CABLE, coaxial (WHT), 18" used
	37-109120	GROMMET rubber
	37-82603D88	SLEEVING coded "A"
	37-82603D93	SLEEVING, coded "F"
	2-82360B34	NUT, speed 1/4-14"; 18 used
	3-135038	SCREW, tapping 14-14 × 3/4"; 18 used
	7-84172N02	BRACKET rack
	9-82578B01	CONNECTOR, "T"
	42-10217A10	STRAP, tie 0.184 × 7.78", 4 used
	47-82977P01	ROD, slide synthesizer; 2 used
	54-83261P01	LABEL, channel and frequency

TRN9039A Chassis Hardware (2-Frequency)
TRN9127A Chassis Hardware (3-Frequency) PL-8689-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-129997	SCREW, machine; 4-40 × 5/16"; 3 used
	3-136850	SCREW, tapping; 6-32 × 1/2"; 4 used
	27-82978P01	CHASSIS
	36-83656P01	KNOB, control
	42-84284P01	RETAINER; 3 used
	15-82979P01	COVER
	38-010388	BUTTON, plug; 2 used (TRN9039A only)

TKN8989A Cable Barrier Strip PL-8690-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle
P1	15-83142M03	HOUSING, 14-contact
		terminal board
TB1	31-824738	15 terminals
		mechanical parts
	39-82717M01	CONTACT, receptacle, 13 used
	42-10217A02	STRAP, tie: .091 × 3.62 (WHT), 6 used



MULTIFREQUENCY
CONTROL MODULE

MODELS TLN2675A (2 FREQUENCY)
TLN2703A (3 FREQUENCY)

NOTES

1. Unless otherwise specified all resistors are in ohms all capacitors are in microfarads and all inductors are in microhenries
2. J3 and J8 are installed in TCN6265A Models only
3. DS4 flashes when S1 selects LOCAL F2 or LOCAL F3 DS4 is off when S1 selects normal F1
4. Integrated circuit connections for this board are as follows

Reference Designation	Mfgr's Description	A+	GND
U1	Timer	8	1
U2, U3	Quad 2-Input NOR Gate	14	7
U4	Triple 3-Input NOR Gate	14	7
U5, U6	Hex Inverter Buffer	1	8
U7	Quad Op Amp	4	11

5. Jumpers are wired for either 2-frequency or 3-frequency operation as follows

Jumper	2-Frequency	3-Frequency
JU1	OUT	OUT
JU2	IN	IN
JU3	OUT	IN

Motorola No. PEPS-38154-O
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MULTIFREQUENCY CONTROL MODULE

MOTOROLA INC.
Communications
Sector

PURC PAGING BASE STATION

928-960 MHz TRANSMIT

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technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

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FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, the applicable schematic diagrams are updated.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 900 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications and Electronics, Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Group products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender" ® and "Vibrasponder" ® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, PROMs, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, PROMs, code plugs, *Vibrasender* and *Vibrasponder* resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used; and should include any serial numbers stamped on the components being replaced.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and
Electronics Inc.
Communications & Electronics Parts
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60196
Phone: 312-576-3900

5.2 U.S. ORDERS

WESTERN AREA PARTS
1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS
1313 E. Algonquin Road
Schaumburg, Ill. 60196
Phone: 312-576-7430
TWX: 910-693-0869

MID-ATLANTIC AREA PARTS
7230 Parkway Drive
Hanover, Maryland 20176
Phone: 301-796-8763
TWX: 710-862-1941

EAST CENTRAL AREA PARTS
12995 Snow Road,
Parma, Ohio 44130
Phone: 216-433-1560
TWX: 810-421-8845

EASTERN AREA PARTS
85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-444-9662
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS
P.O. Box 85036
San Diego, California 92138
Phone: 714-578-8030
TWX: 910-335-1516

GULF STATES AREA PARTS
1140 Cypress Station
P.O. Box 73115
Houston, Texas 77090
Phone: 713-537-3636
TWX: 910-881-6392

SOUTHWESTERN AREA PARTS
P.O. Box 34290
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-620-8511
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS
P.O. Box 368
Decatur, Georgia 30031
Phone: 504-987-2232
TWX: 810-766-0876

5.3 CANADIAN ORDERS

MOTOROLA LTD.
National Parts Department
3125 Steeles Avenue East
Willowdale, Ontario M2H 2H6
Phone: 416-499-1441
TWX: 610-491-1032
Telex: 06-526258

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC.
International Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196 U.S.A.
Phone: 312-576-6492
TWX: 910-693-0869
Telex: 722443
Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS, PROMs, AND RESONANT REED ORDERS

ALL MAIL ORDERS
Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

CORRESPONDENCE
Motorola, Inc.
Component Products Sales & Service
2553 N. Edgington Street
Franklin Park, Illinois 60131
Phone: 312-451-1297
TWX: 910-227-0799
Telex: 433-0067

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

EPS-28750-O

PERFORMANCE SPECIFICATIONS

GENERAL

Model	C75JZB Series
Number of Frequencies	Single Frequency Stations (Local/Tone Remote Control/Simulcast Control)
AC Power Input	120 V, 60 Hz, single phase (3-lead grounding-type cable supplied)
AC Current	Standby: 2.6A at 121 V, 60 Hz Transmit: 7.6A at 121 V, 60 Hz
Metering	2 panel-mounted meters provide indication of power amplifier voltage & current essential for tuning and checking. Optional internal-mounted meter used to measure exciter & receiver circuits essential for tuning and checking.
Dimensions	60"H × 22.25"W × 19.25"D (150 × 55.6 × 48cm)
Weight	300 lbs. (140 kg)

TRANSMITTER

Frequency	928-960 MHz
RF Power Output	60 to 125 watts, variable
Output Impedance	50 ohms
Final RF Amplifier	3CX400U7 Type Tube
Frequency Stability	Standard Models: ±.0001% from −30°C to +60°C ambient (25°C ref.) Simulcast Models: ±.0000002% from −30°C to +60°C ambient (25°C ref.) ±.000004% per year long term aging
Conducted Spurious & Harmonic Emissions	−85 dB
Modulation	15F2, 16F3 & 16F9Y ±5 kHz for 100% @1000 Hz
Audio Sensitivity Local Control	0.12 V ±3 dB for 60% max. deviation @1000 Hz
Audio Response — EIA	+1, −3 dB from 6 dB/octave pre-emphasis 300-3000 Hz reference to 1000 Hz. Flat within ±1 dB 250-2800 Hz, reference to 1000 Hz (optional)
Audio Distortion	Less than 2% @1000 Hz; 60% system deviation
Remote Telephone Line	−20 dBm max. for 60% max. deviation @1000 Hz

MONITOR RECEIVER (OPTIONAL)

Frequency	928-960 MHz
Channel Spacing	25 kHz
EIA Modulation Acceptance	±8 kHz minimum
Selectivity — EIA SINAD	−80 dB
Frequency Stability	−.0002% from −30°C to +60°C ambient (+25°C ref.)
Sensitivity — 20 dB quieting EIA SINAD	Less than 0.5 uV Less than 0.35 uV
Intermodulation — EIA SINAD	−75 dB
Spurious & Image Rejection	100 dB
Squelch Sensitivity — Carrier Squelch (adjustable)	6 dB Quieting (.25 uV or less at threshold)
Audio Characteristics — Remote Control Models	Telephone Line: Output: +18 dBm at 600 ohms Response: +1, −3 dB Distortion: 3% at 1000 Hz Hum & Noise: −55 dB For Local Speaker: Output Available: 5 watts at 8 ohms Response: +2; −8 dB Distortion: 5% at 1000 Hz Hum & Noise: −50 dB
RF Input Impedance	Nominal 50 ohms

FCC INFORMATION

All Models	Applicable Part of Rules Parts 22, 90
Authorized Emissions	15F2, 16F3, and 16F9Y

Stability	**Type Acceptance Number**
Standard Models	ABZ89FC5601
Simulcast Models	ABZ89FC5602

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

STATION MODEL CHART

CODE:

● = ONE SUPPLIED

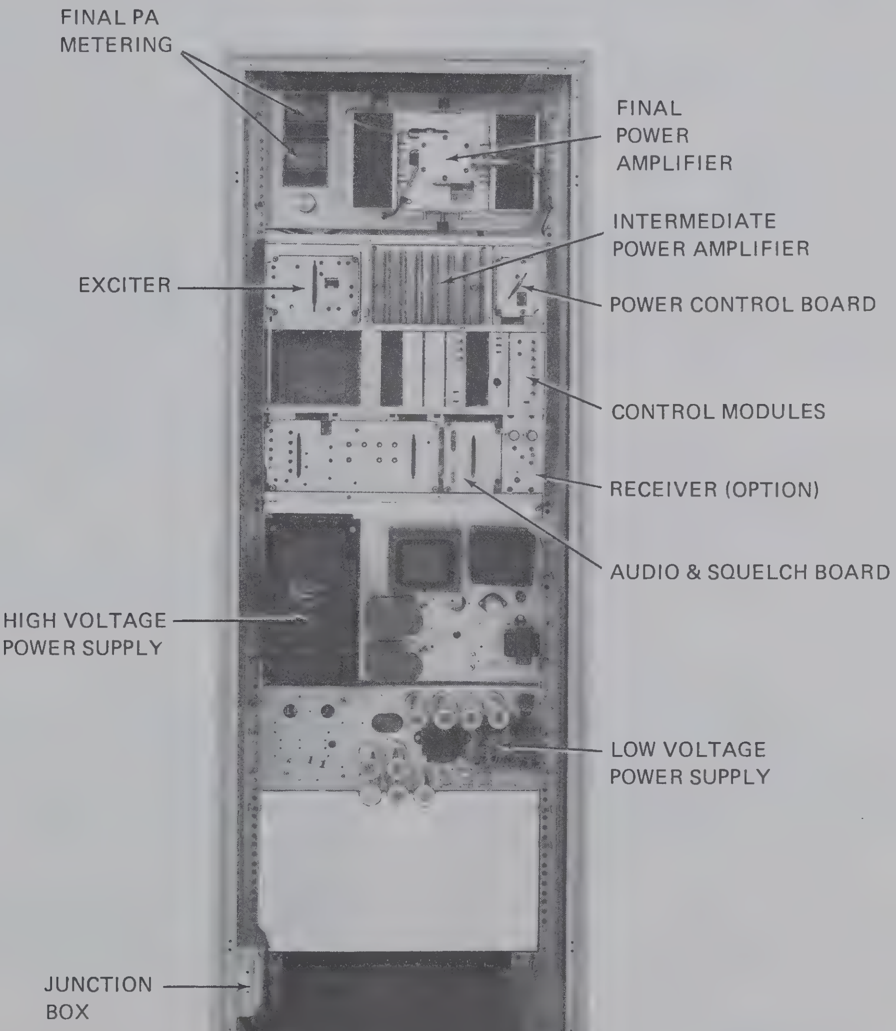
MODEL	FREQ.	DESCRIPTION
C75JZB1101A	928-960 MHz	PAGING STATION (SYNTHESIZED)
C75JZB1106A	928-960 MHz	TONE REMOTE CONTROL

C75JZB1101A	C75JZB1106A			ITEM	DESCRIPTION
●	●			TCN1367A	UNIFIED CONTROL CHASSIS
●	●			THN6304A	CABINET, 60"
●	●			TKN8212A	INTERCONNECT CABLE
●	●			TKN8214A	MODEM CABLE
●	●			TKN8244A	FUSE CABLE
●	●			TLF1192A	EXCITER & BANDPASS FILTER, 153-160 MHz
●	●			TLF1202A	HYBRID TRIPLER DOUBLER, 928-960 MHz
●	●			TLF1212A	IPA, 928-960 MHz
●	●			TLF1222A	PA, 125 W, 928-960 MHz
●	●			TLF1232A	DIRECTIONAL COUPLER
●	●			TLN2376A	GUARD TONE DECODER
	●			TLN4290B	AUDIO PA
●	●			TLN5703A	TRANSFORMER LB
●	●			TLN5891A	RCVR SHLD
●	●			TPN1147A	POWER SUPPLY HV
●	●			TPN1148A	POWER SUPPLY LV
●				TPN1195A	POWER SUPPLY, 24 V
●				TLE1342A	SYNTHESIZER, 928-960 MHz
●	●			TRN4845A	POWER CONTROL BOARD
●	●			TRN4846A	HARDWARE STATION, 125 W
	●			TRN4847A	OSC. BRKT
	●			TRN4853A	TRANSMITTER SITE INTERFACE MODULE
●	●			TRN4854B	STATION CONTROL MODULE
	●			TRN4856B	DIGITAL MODULATION MODULE
●	●			TRN4859A	STATION LINE DRIVER BOARD
●	●			TRN6192A	TRANSMITTER SHIELD, 12 W
●				TRN5481A	PROM
●	●			TRN6587A	POWER JUNCTION BOX
●	●			TRN6729A	BLOWER & SHROUD
	●			TRN8406A	AUDIO SQUELCH, 10 W
●	●			TRN8686A	CARD PULLER
●				TLN8799A	SERVICE BOARD
●				TRN5609A	SYNTHESIZER HARDWARE
	●			TLN4658A	F1 CONTROL MODULE
●				TLN2559A	SIMULCAST CONTROL MODULE
●				TLN5293A	F1 TONE DECODER MODULE
●				KXN1052A	XMTR CHANNEL ELEMENT

EPS-35191-O

Options Chart

Option	Description	Publication Reference
C11AC	Add Time-Out Timer	68P81044E69 p/o 68P81060E70
C36AW	75'' Outdoor Cabinet	PEPS-21043
C40AQ	70'' Indoor Cabinet & Meters	DEPS-15048
C47AD	Internal Wattmeter	68P81062E48 p/o 68P81060E70
C149BT	DC Metering w/Intercom	68P81033E28
C153AB	50' Modem Cable	None
C154AC	100' Modem Cable	None
C226AC	Service Intercom	PEPS-17760
C307AF	70'' Indoor Cabinet w/o Metering	DEPS-15048
C366AB	Transmitter Flat Audio Response	PEPS-34631 p/o 68P81060E70
C501AH	Omit Transmitter Channel Element	None
C521AQ	Omit Receiver Channel Element	None
C578AA	Alarm Logic Module	68P81062E71 p/o 68P81060E70
C583AA	Voice Actuated Response	68P81048E69 p/o 68P81061E95
C659AF	UHF Link Receiver Carrier Squelch	68P81063E10
C660AF	900 MHz Link Receiver Carrier Squelch	68P81063E10
C661AF	72 MHz *Digital Private-Line* Squelch Link Receiver	68P81063E10
C662AF	UHF Link Receiver *Digital Private-Line* Squelch	68P81063E10
C663AF	Receiver 900 MHz Link	68P81063E10
C664AJ	Monitor Receiver Carrier Squelch 900 MHz	68P81063E10
C665AG	Monitor Receiver *Private-Line* Squelch 900 MHz	68P81063E10
C666AB	Omit Simulcast Control	None Required


FINAL PA
METERING
FINAL
POWER
AMPLIFIER
INTERMEDIATE
POWER AMPLIFIER
EXCITER
POWER CONTROL BOARD
CONTROL MODULES
RECEIVER (OPTION)
AUDIO & SQUELCH BOARD
HIGH VOLTAGE
POWER SUPPLY
LOW VOLTAGE
POWER SUPPLY
JUNCTION
BOX

FAEPS--35421--O
(M604)

1. MANUAL USAGE

This manual describes all aspects of the 928-960 MHz *PURC* (Paging Universal Remote Control) Paging Base Station radios except remote control and station applications. Separate Control and Applications manual 68P81060E70 describes how these stations are remotely controlled and outlines the functioning of the *PURC* Radio Paging Stations.

2. 900 MHz CONSIDERATIONS

Radio equipment operating in the 900 MHz band requires some special considerations over and above requirements for radios operating at lower frequencies. Some of these special considerations are:

- TEST EQUIPMENT — Test equipment must cover the frequency range and have the accuracy required. The 900 MHz base station transmitters have a frequency stability requirement of 0.0001% for the synthesized station, therefore, stability of frequency measuring devices should be at least ten times that of the transmitter (i.e. 0.00001%). Frequency generators used for alignment should be calibrated for both frequency and output in the 900 MHz band. Wattmeters, dummy loads, and termination devices should be checked for proper frequency specifications and calibrated required.
- CABLES AND CONNECTORS — Cable and connector attenuation is much higher at 900 MHz than at lower frequencies. Therefore, types RG8 and RG58 cables used at lower frequencies are not recommended for the 900 MHz band. Where flexible cable is required, recommended types are RG87 and RG400. "UHF" type connectors are not recommended for this frequency, instead, type "N" and "BNC" connectors are recommended. A particular phenomenon which can be noticed at 900 MHz is cable heating. Under normal operating conditions, rf cables can become warm or even hot. This is a normal condition and does not necessarily indicate a defective cable or a high VSWR ratio. To confirm malfunctions, insert a directional wattmeter in the line.

3. EQUIPMENT DESCRIPTION

3.1 TRANSMITTER

NOTE

Stations in the 900 MHz band are FCC-licensed to operate at or below a specified effective radiated power (ERP). The ERP of the station is related to the rf power output of the transmitter, antenna transmission line loss, antenna height and antenna gain. The maximum rf power output of the transmitter that will be permitted without violating the licensed ERP

NOTE (Cont'd.)

for each specific station must be determined by a communications specialist. This rf power figure may be equal to or below the maximum capability of the station. Record the figure for reference in future servicing and alignment of the station.

The transmitter generates a frequency modulated rf carrier signal of various power output levels. Refer to Figure 1 (block diagram) for functional operation. The transmitter consists of the following eight items:

- Channel Element or Synthesizer — A high stability, oven controlled crystal oscillator plug-in module (channel element) provides a stable fundamental rf frequency for the transmitter. A synthesizer replaces the channel element in synthesized stations.
- Exciter — the exciter provides the low power excitation signal for the transmitter. An *IDC* (Instantaneous Deviation Control) circuit amplifies and limits audio signals from the microphone (or line) to prevent over deviation. Amplified audio is applied to the channel element to produce direct FM modulation. Digital modulation is achieved by directly modulating the channel element as in the non- synthesized station. Multipliers in the exciter multiply the channel element frequency 12 times to generate an output frequency signal in the 154.66 to 160 MHz band.
- First Bandpass Filter — The first bandpass filter couples 154.66-160 MHz signals from the exciter to the tripler and doubler and attenuates any harmonics outside this band.
- Tripler/Doubler-Amplifier — The exciter output is tripled and doubled in these stages. A bandpass filter, electrically located between the tripler and doubler, filters the tripled signal and attenuates harmonics. A low level amplifier couples the doubler output to the intermediate power amplifier.
- Intermediate Power Amplifier (IPA) — The IPA is a variable 14 W amplifier used to drive the final power amplifier. Amplification is controlled by the power control board.
- Directional Coupler — The directional coupler samples forward power from the IPA and reflected power from the final power amplifier and applies both to the power control board.
- Power Control Board — The power control board operates as a control loop which examines forward and reflected power. It regulates the bias to the IPA, the drive power to the PA, and protects against excessive VSWR.

- Final Power Amplifier — The final power amplifier employs an EIMAC 3CX400U7/8961 UHF Transmitting Triode to provide a final rf power output of 60 to 125 watts. The unit is driven by the rf signal from the directional coupler. The output passes through a harmonic filter and is applied to the antenna output connector (or antenna relay, for stations with monitor receiver only).

3.2 RECEIVER

NOTE

This receiver description has been included for completeness only. Details about the receiver can be found in the Link Receiver Option manual (68P81063E10). The receiver is used in monitor receiver or link receiver options only.

The receiver accepts rf carrier signals on a specific channel in the 928-960 MHz range and provides voice audio in the 300-3000 Hz range. Refer to Figure 1 (block diagram) for functional operation. The receiver consists of the following items:

- Channel Element — A plug-in, temperature compensated crystal oscillator module (channel element) provides stable frequency control for each frequency of operation.

- Receiver RF and I-F Board — This double conversion, superheterodyne FM receiver includes a five cell preselector and three crystal filters for excellent selectivity. Two integrated circuit i-f amplifiers and limiters provide high sensitivity. A crystal discriminator demodulates the audio directly from an 11.7 MHz second i-f signal.

- Audio & Squelch and Audio Power Amplifier Boards — Up to 5 watts of audio power at less than 5% distortion is provided by this circuit. When no messages are being received, the squelch circuit turns off the audio amplifiers to eliminate annoying noise in the speaker. A squelch tail eliminator circuit prevents the noise burst at the end of a message for strong signals. For weak signals, the squelch tail eliminator circuit is automatically inhibited to prevent loss of portions of messages. The audio power amplifier transistors are mounted on a separate circuit board and aluminum heat sink for necessary heat dissipation.

3.3 POWER SUPPLY

This station uses a high and low voltage power supply system to provide station dc operating voltages. The station cabinet is provided with a safety interlock switch to reduce shock hazard.

- High Voltage Power Supply — The high voltage power supply produces the necessary voltages for plate current and PA tube bias and the ac voltages used to drive the low voltage power supply. It employs a ferro-resonant transformer to maintain output voltages to within ±3% with a ±20% line change.

- Low Voltage Power Supply — This power supply produces regulated dc voltages for the PA tube filament and all the solid-state circuitry of the station. It employs a filament protection and timing circuit for transmit inhibit during station warm-up.

4. VOLUME AND SQUELCH CONTROLS

Receiver VOLUME and SQUELCH controls are located on the receiver chassis (all other operational circuits and their controls are on plug-in modules inserted into the unified control chassis). The RECEIVER VOLUME control only affects local speaker operation (when used).

NOTE

The SQUELCH control affects both local and remote operation.

5. *DIGITAL PRIVATE-LINE* BINARY-CODED SQUELCH OPERATION

This type of operation is similar to *Private-Line* tone-coded squelch operation but with greatly expanded code capability. Refer to separate instruction manual 68P81106E83 for complete details. The receiver with DPL is used only in Link Receiver options.

6. ACCESSORIES

For a simulcast paging system at 900 MHz Motorola supplies all components that make such a system work effectively. The system includes paging terminals, simulcast system controllers, rf link equipment, rf synthesized paging stations and pagers. Please contact your Motorola area sales representative for further details. Some additional items required to complete the installation are:

6.1 ANTENNA AND TRANSMISSION LINE

An antenna and transmission line kit is available from Motorola on separate order. The type used should be determined by a qualified radio communications engineer and will depend upon local operating conditions.

6.2 OPTIONAL ACCESSORIES

Many optional accessories are available as factory installed items in new stations, and as "add-to" items for field installation. Many of those optional accessories are described in this manual. Other accessories may become available after the printing of this manual. Also, other accessories are available which have more special application than those listed herein.

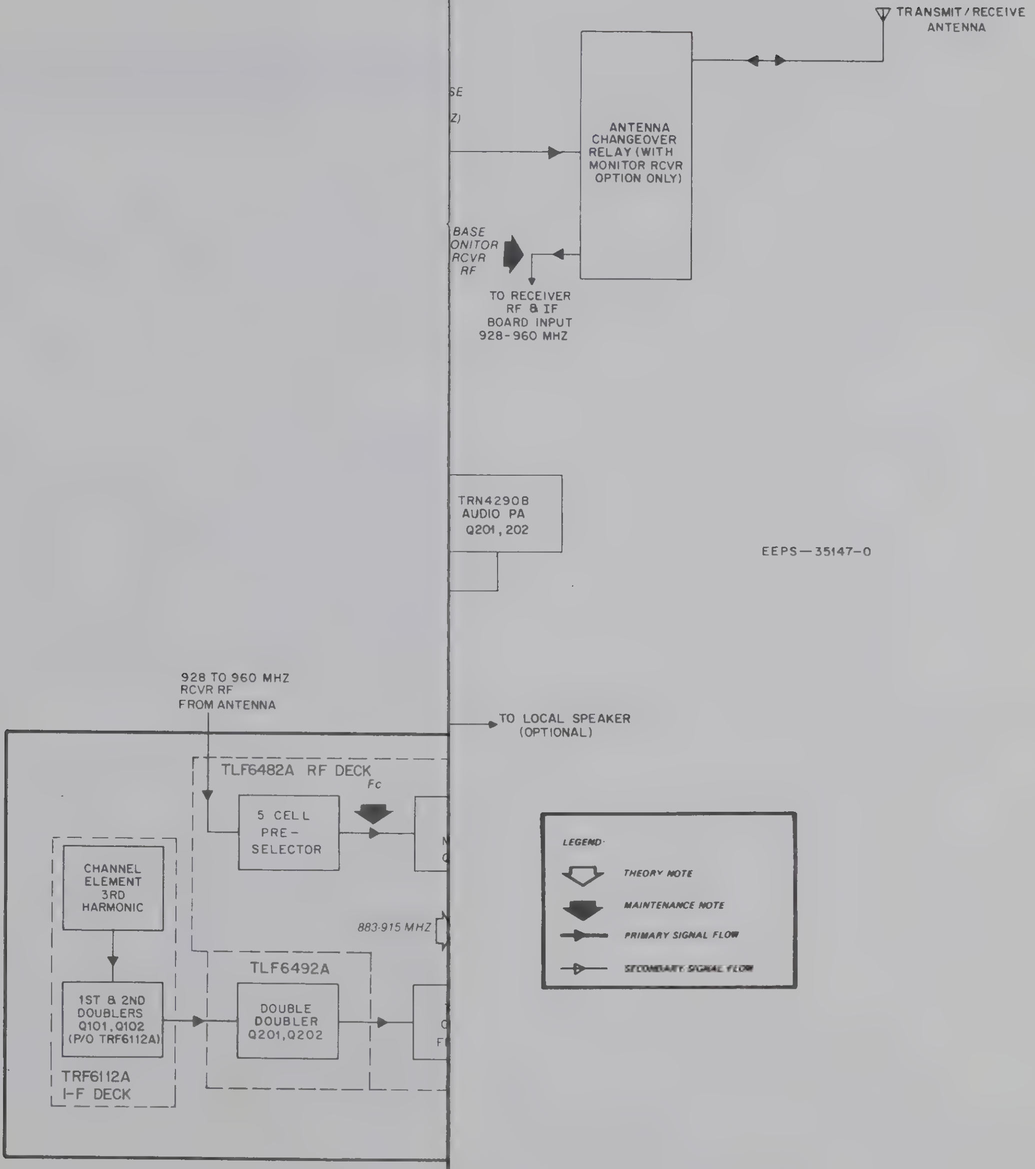

TRANSMIT / RECEIVE ANTENNA
SE
Z)
ANTENNA CHANGEOVER RELAY (WITH MONITOR RCVR OPTION ONLY)
BASE
ONITOR
RCVR
RF
TO RECEIVER RF & IF BOARD INPUT 928-960 MHZ
TRN4290B AUDIO PA Q201, 202
EEPS—35147-0
928 TO 960 MHZ RCVR RF FROM ANTENNA
TO LOCAL SPEAKER (OPTIONAL)
TLF6482A RF DECK
Fc
5 CELL PRE-SELECTOR
CHANNEL ELEMENT 3RD HARMONIC
883-915 MHZ
TLF6492A
1ST & 2ND DOUBLERS Q101, Q102 (P/O TRF6112A)
DOUBLE DOUBLER Q201, Q202
TRF6112A I-F DECK
LEGEND
THEORY NOTE
MAINTENANCE NOTE
PRIMARY SIGNAL FLOW
SECONDARY SIGNAL FLOW

Figure 1. Transmitter/Receiver Block Diagram

are described in this manual. Other accessories may become available after the printing of this manual. Also, other accessories are available which have more special application than those listed herein.

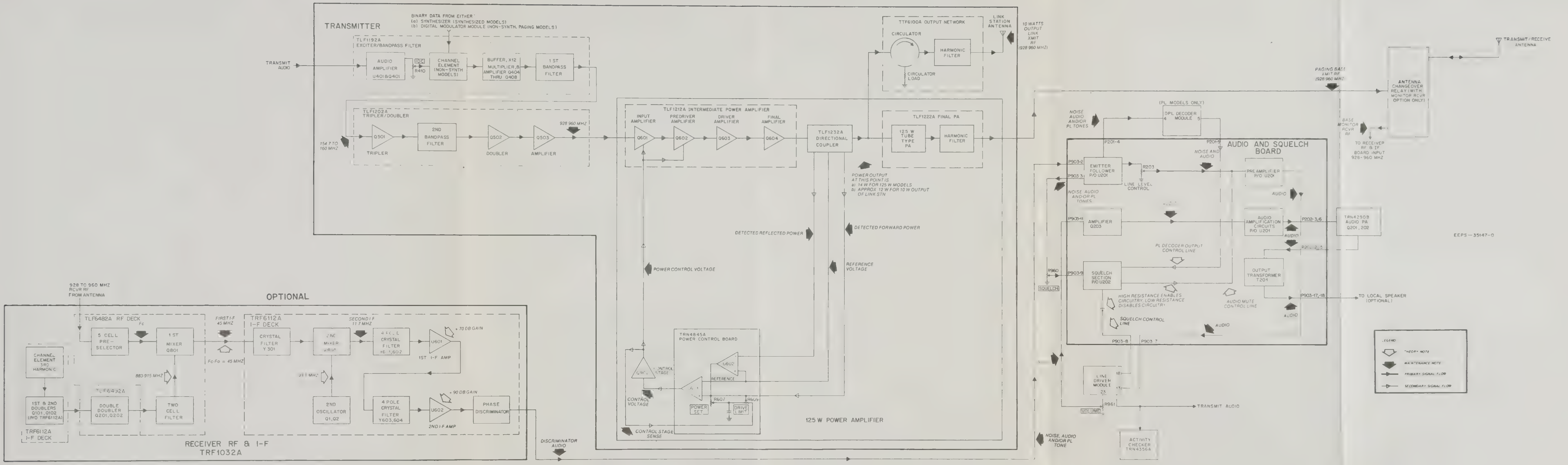

TRANSMITTER
BINARY DATA FROM EITHER
(a) SYNTHESIZER (SYNTHESIZED MODELS)
(b) DIGITAL MODULATOR MODULE (NON-SYNTH. PAGING MODELS)
TRANSMIT AUDIO
TLF1192A
EXCITER/BANDPASS FILTER
AUDIO AMPLIFIER U401&Q401
IDC
R410
CHANNEL ELEMENT (NON-SYNTH MODELS)
BUFFER, X12 MULTIPLIER,& AMPLIFIER Q404 THRU Q408
1 ST BANDPASS FILTER
TLF1202A
TRIPLER/DOUBLER
154 7 TO 160 MHZ
Q501
TRIPLER
2ND BANDPASS FILTER
Q502
DOUBLER
Q503
AMPLIFIER
928 960 MHZ
TLF1212A INTERMEDIATE POWER AMPLIFIER
INPUT AMPLIFIER
PREDRIVER AMPLIFIER
DRIVER AMPLIFIER
FINAL AMPLIFIER
Q601
Q602
Q603
Q604
TLF1232A DIRECTIONAL COUPLER
TTF6100A OUTPUT NETWORK
CIRCULATOR
CIRCULATOR LOAD
HARMONIC FILTER
LINK STATION ANTENNA
10 WATTS OUTPUT LINK XMIT RF (928 960 MHZ)
TLF1222A FINAL PA
125 W TUBE TYPE PA
HARMONIC FILTER
POWER OUTPUT AT THIS POINT IS
a) 14 W FOR 125 W MODELS
b) APPROX 12 W FOR 10 W OUTPUT OF LINK STN
DETECTED REFLECTED POWER
DETECTED FORWARD POWER
POWER CONTROL VOLTAGE
REFERENCE VOLTAGE
TRN4845A
POWER CONTROL BOARD
U602
REFERENCE
CONTROL STAGE
CONTROL VOLTAGE
R607
R609
POWER SET
DRIVE LIMIT
CONTROL STAGE SENSE
125 W POWER AMPLIFIER
OPTIONAL
928 TO 960 MHZ RCVR RF FROM ANTENNA
TLF6482A RF DECK
Fc
5 CELL PRE-SELECTOR
1 ST MIXER Q801
CHANNEL ELEMENT 3RD HARMONIC
883-915 MHZ
1ST & 2ND DOUBLERS Q101, Q102 (P/O TRF6112A)
TLF6432A
DOUBLE DOUBLER Q201, Q202
TWO CELL FILTER
TRF6112A
I-F DECK
FIRST I-F 45 MHZ
Fc-Fo = 45 MHZ
TRF6112A
I-F DECK
CRYSTAL FILTER Y301
2ND MIXER
SECOND I F 11 7 MHZ
4 POLE CRYSTAL FILTER
U601
+ 70 DB GAIN
1ST I-F AMP
2ND OSCILLATOR Q1, Q2
4 POLE CRYSTAL FILTER Y603, 604
U602
+ 90 DB GAIN
2ND I-F AMP
PHASE DISCRIMINATOR
RECEIVER RF & I-F
TRF1032A
DISCRIMINATOR AUDIO
NOISE AUDIO AND/OR PL TONES
(PL MODELS ONLY)
DPL DECODER MODULE
4
5
P201-4
P201-5
AUDIO AND SQUELCH BOARD
NOISE AND AUDIO
P903-2
P903-3
EMITTER FOLLOWER P/O U201
R203
LINE LEVEL CONTROL
PREAMPLIFIER P/O U201
NOISE AUDIO AND/OR PL TONES
AUDIO
P903-11
AMPLIFIER Q203
AUDIO AMPLIFICATION CIRCUITS P/O U201
P202-3, 6
AUDIO
TRN4290B AUDIO PA Q201, 202
PL DECODER OUTPUT CONTROL LINE
R960
P903-9
SQUELCH
SQUELCH SECTION P/O U202
OUTPUT TRANSFORMER T201
HIGH RESISTANCE ENABLES CIRCUITRY, LOW RESISTANCE DISABLES CIRCUITRY
AUDIO MUTE CONTROL LINE
P903-17, -18
TO LOCAL SPEAKER (OPTIONAL)
AUDIO
SQUELCH CONTROL LINE
AUDIO
P903-8
P903-7
LINE DRIVER MODULE
18
13
23
R961
VOLUME
TRANSMIT AUDIO
NOISE, AUDIO AND/OR PL TONE
ACTIVITY CHECKER TRN4356A
PAGING BASE XMIT RF (928 960 MHZ)
ANTENNA CHANGEOVER RELAY (WITH MONITOR RCVR OPTION ONLY)
TRANSMIT/RECEIVE ANTENNA
BASE MONITOR RCVR RF
TO RECEIVER RF & IF BOARD INPUT 928-960 MHZ
EEPS—35147-0
LEGEND
THEORY NOTE
MAINTENANCE NOTE
PRIMARY SIGNAL FLOW
SECONDARY SIGNAL FLOW

Figure 1. Transmitter/Receiver Block Diagram

MOTOROLA INC.
Communications
Sector

INSTALLATION & INITIAL ADJUSTMENTS

1. UNPACKING

When unpacking the radio from its shipping carton, refer to the model chart at the front of this manual. If any item is missing, contact your Motorola representative immediately.

2. LICENSING REQUIREMENTS

FCC regulations state that a station license must be obtained for each radio installation (mobile or base) by the owner of the equipment. The station licensee is responsible for ensuring that the transmitter power, frequency, and deviation are within the limits permitted under the station license. Adjustments to the transmitter section of the radio may be made only by a technician possessing an FCC general class, or first or second class radiotelephone operator's license. No operator's license is required to install or operate the radio.

3. PLANNING THE INSTALLATION

Since a good installation is important to obtain the best possible performance of the communications system, carefully plan the installation before actual work is started. Location of the station in relation to power, control lines, the antenna, convenience and access for servicing should be considered. The cabinet dimensional detail diagrams show the size of the various cabinets for planning the space requirements. Read the entire procedure and the many suggestions offered to help you plan your installation. Make sure all tools, equipment and facilities are available when the installation is begun.

4. VENTILATION

Although a blower has been provided for cooling the PA tube, the remaining cabinet components are designed for operation without forced ventilation. The cabinet door has openings at the top and bottom, which provide a natural draft. It is therefore essential that the door openings be kept free of obstructions so air flow will not be restricted.

5. INSTALLATION OF 60-INCH INDOOR *COMPA-STATION* CABINETS

5.1 Refer to cabinet drawings at the end of this section for cabinet dimensional details.

5.2 The cabinet should be located on a solid, level surface convenient to the power source and the transmission line. The transmission line should be kept as short as possible to minimize line losses.

5.3 All antenna, power, and control lines may be brought through the notch at the bottom of the rear door. Any or all of these lines may be brought out through the bottom, side or top of the cabinet, if desired, by drilling a hole in the cabinet at the desired position.

CAUTION

Before drilling, check location of proposed hole and verify that equipment will not be damaged by the drilling.

6. INSTALLATION OF 75-INCH "OUTDOOR" CABINETS (OPTIONAL)

6.1 GENERAL

6.1.1 Refer to cabinet drawings at the end of this section for cabinet dimensional details.

6.1.2 The outdoor station may be installed in any convenient location (indoors or outdoors) which provides space to open the front and rear doors. If it is installed outdoors, the rain shield kit (which is packed with the cabinet) should be installed as described in this section. With these installed, the station is protected against all normally encountered elements such as rain, snow, or sleet.

6.1.3 The station is not intended to withstand submersion in water. If pools of water could gather around the cabinet base, it is recommended that the cabinet be elevated on a suitable supporting platform.

6.1.4 Although the cabinet is built to be installed outdoors, it should be realized that maintenance of the station is not easily accomplished in inclement weather. It is therefore recommended that the station be installed inside of an enclosure which would provide protection for the serviceman and the test equipment he may be using. One such enclosure would be an elevator penthouse or a small building no less than six feet square and eight feet tall as measured on the inside.

6.1.5 The cabinet should be located on a solid, level surface convenient to the power source and the transmission line. The transmission line should be kept as short as possible to minimize line losses.

6.2 75-INCH CABINET RAIN HOOD AND VENT SHIELD INSTALLATION

6.2.1 General

The rain hood is provided to cover the air vent in the top of the cabinet and the vent shield to cover the opening in the rear door.

6.2.2 Installation of Rain Hood

Step 1. Install the main section (largest fabricated assembly) over the opening in the top of the cabinet using the rectangular shaped gasket and 1/2-inch sheet metal screws provided.

Step 2. Mount the small rectangular cover inside the main section using the machine screws provided.

Step 3. Similarly, mount the larger cover on top of the whole assembly.

6.2.3 Installation of Vent Shield

Mount the awning-shaped vent shield over the opening in the rear door using the "U" shaped gasket and 3/8-inch sheet metal screws. Place the acorn nuts over the screws to cover exposed threads.

7. ANTENNA CONNECTIONS

7.1 INTRODUCTION

7.1.1 The antennas and transmission lines are not part of the station. Therefore, antenna installation instructions are not included in this section. Follow the instructions shipped with the antennas for applicable information.

7.1.2 In its primary application, the station is used for communication. Thus, antennas having omnidirectional characteristics are desirable. However, if the station is located at the outer perimeter of a communications area, or if it is to be used for communications with fixed stations, antennas with specific directional characteristics may be more suitable. FCC requirements may also dictate the type of antenna to be used.

7.1.3 For *PURC* Paging Base Stations, the antenna coaxial cable connects to the antenna network output with a type N connector. For *PURC* Paging Base Stations with the link receiver option, (without an optional duplexer), two antennas are required, one for the transmitter and one for the receiver. The antenna coaxial cables connect directly to the transmitter and receiver. The transmitter output requires a type N connector at the antenna network output — the receiver input requires a type BNC connector. For *PURC* Paging Base Stations with an optional monitor receiver option, an antenna relay is provided with the station. Only a single antenna is required. Both receiver and transmitter are connected to the antenna relay, which in turn is connected to the antenna. (Refer to Figure 1.)

7.1.4 Cable attenuation is a significant factor at 900 MHz. Therefore, whenever a flexible cable is needed, the recommended cables will be 30-83794C01 (RG87) and 30-84173E01 (RG400). If flexibility is not a requirement, then a heliax line should be used. In all usage of flexible cable, keep the line as short as possible.

7.2 60-INCH INDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

Step 1. The antenna coaxial cable(s) may be brought through the notch at the bottom of the rear door. Cable(s) may be brought out through the bottom, side, or top of the cabinet, if desired, by drilling a hole in the cabinet at the desired position.

Step 2. Connect the antenna cable(s) as shown in Figure 1.

CAUTION

Be careful to determine internal clearance before drilling access holes. A 3/4-inch diameter hole allows conduit to be installed for cable runs. If conduit is not used, install rubber grommets in the holes to protect the cable(s).

7.3 75-INCH OUTDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

Step 1. A flange-type bulkhead fitting should be used to make a weatherproof entry for the antenna transmission line(s). The recommended location for the fitting is on the right side of the cabinet (as viewed from the front) with its center 21 inches from the top and 7 inches from the rear. Any alternate location must be selected with caution to insure that the area is clear of chassis, framework, etc.

Step 2. Install connectors as required.

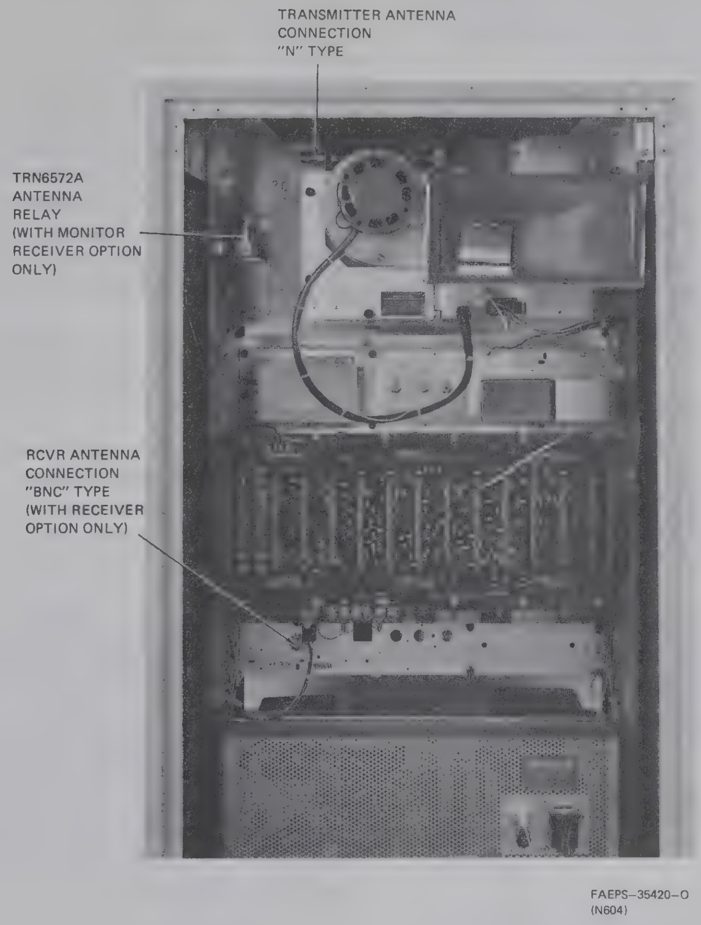

TRANSMITTER ANTENNA
CONNECTION
"N" TYPE
TRN6572A
ANTENNA
RELAY
(WITH MONITOR
RECEIVER OPTION
ONLY)
RCVR ANTENNA
CONNECTION
"BNC" TYPE
(WITH RECEIVER
OPTION ONLY)
FAEPS–35420–O
(N604)

Figure 1. Antenna Connection Locations

8. AC INPUT POWER CONNECTIONS

8.1 INTRODUCTION

8.1.1 All stations should have a separate power circuit from a 10-ampere (minimum), 120 V ac, 60 Hz power source. The power lines should be installed in accordance with local electrical codes.

8.1.2 The primary ac power line may be installed prior to installation of the cabient and terminated near the location chosen for the station.

8.1.3 An ac power cord of 9 feet is supplied with each station. Direct conduit connections may also be made by replacing this power cord.

8.2 60-INCH INDOOR/CABINET POWER CONNECTIONS

8.2.1 Indoor and outdoor power connections are identical except that outdoor station requires additional weatherproofing.

WARNING

If a three wire grounded primary ac power source is not available, the radio equipment must be grounded separately to prevent electrical shock hazards and provide lightning protection.

8.2.2 Connect the three-wire ac line cord to the ac outlet. A power on-off switch is provided in the equipment.

8.2.3 All power to the station (except ac power to the outlet in the power supply) is protected by fuses.

8.3 75-INCH OUTDOOR CABINET POWER CONNECTION

8.3.1 For bottom cable entry, power and control cables may be brought in at almost any desired point through the bottom of the cabinet. Measure and center punch the desired cable entry locations. Using the center punch marks as the center of the holes, drill 3/4-inch holes with a hole saw. Install rubber grommets in the holes to protect the cables. Seal the entry to make the opening as weatherproof as possible.

8.3.2 For rear cable entry, two punch marks are located on the rear panel of the cabinet base. Using these as centers, drill holes in the cabinet with a 3/4-inch hole saw. When facing the rear, the right-hand hole is intended for the entrance of ac power and the left-hand hole is intended for the entrance of control lines. Install rubber grommets in the holes to protect the cables. Seal the entry to make the opening as weatherproof as possible.

8.4.2 Transmission Lines Terminated in Female Connector

Step 1. Secure the transmission line (through the appropriate knockout) directly to the cabinet top with the nut supplied.

Step 2. Measure and cut a piece of coaxial cable so that it will reach between the station output connector and the transmission line connector in the cabinet top.

Step 3. Install the connectors as required.

9. OPTIONAL MODE JUMPERING

9.1 GENERAL

9.1.1 Many station modes of operation are determined by jumper connections at the time of installation.

9.1.2 All jumpers for control applications are described in *PURC* Control & Application instruction manual 68P81060E70. Additional jumpering may be found in applicable sections in this manual.

10. CONTROL LINE CONNECTIONS — INSTALLATION

10.1 GENERAL

The control line may be installed prior to installation of the cabinet and terminated near the location chosen for the station. Conduit or two-wire cable can be used from this termination to the station cabinet.

10.2 SPECIFIC CONNECTION INFORMATION

Connect the 600-ohm lines to the screw terminals on the rear of the unified chassis interconnect board as shown in Figure 2. (In 2-wire applications, use line 1 connections.)

11. CONTROL LINE LEVEL ADJUSTMENT

11.1 INTRODUCTION

Most telephone companies limit the maximum signal amplitude which they allow on their lines. This maximum amplitude is usually specified in RMS speech level is approximately 4 dB lower than a tone set at speech peaks. Therefore, when a tone set at peak speech level (such as the status tone from a *Spectra TAC* receiver) is used to set line level, it may be set 4 dBm above the specified RMS speech level.

NOTE

The following level setting information is applicable for non-simulcast systems.

11.2 PROCEDURE

11.2.1 General

11.2.1.1 A local speaker at the station may be used for testing and level settings. If the station is equipped with built-in metering, it includes a local speaker. If not, the speaker in a Motorola portable test set may be used by connecting the test set with *Micor* adapter to the control receptacle (J3) on the unified chassis interconnect board. Otherwise, a *Micor* mobile speaker can be connected to the local speaker pins (J4-1 and -12 of unified chassis interconnect board). The receiver VOLUME control set the audio level at the local speaker only.

11.2.1.2 Exciter audio should be measured at the microphone input to the exciter and adjusted for the sensitivity value stamped on the exciter. If the station is equipped with optional built-in metering, this may be measured at pins 1 and 2 of the local microphone jack. If not, it may be measured at J4-15 and -14 of unified chassis interconnect board or on the portable test set.

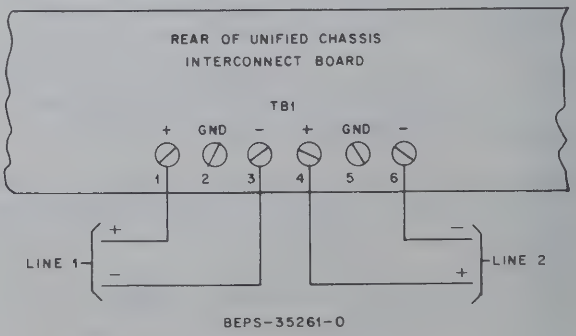


Figure 2. Control Line Connections

11.2.1.3 *Private-Line* squelch receivers must be PL disabled during adjustments with the PL DISABLE switch on the station control module. In *Private-Line* repeaters, the squelch gate must also be set for carrier squelch operation during adjustments by connecting jumper JU14 to the active pin and JU15 to the dummy pin. Be sure to return the jumpers to the PL condition after adjustments are complete.

11.2.1.4 If the station is equipped with a single-tone decoder module for repeater access unplug the single-tone decoder during adjustments.

11.2.2 Wire Line Controlled *PURC* Paging Base Stations

11.2.2.1 Determine the maximum allowable audio level permitted on the lines (use +2 vu for non-regulated lines) and set line audio levels to this amplitude. Refer to the 600 Ohm, VU, DBM and Voltage Equivalency Chart for tone levels to be used.

NOTE

The following procedures assume the +8 vu speech level (+14 dBm tone level). For other speech levels, use a tone level 6 dB higher than the vu level (for 0 vu use +6 dBm); refer to the equivalency chart. On some lines, tone levels are not permitted to exceed the speech levels, even for short test tones (for example, maximum speech level of 0 vu and maximum tone level of 0 dBm). When such regulations apply, use the special procedures for low level test tone.

11.2.2.2 As mentioned previously, the lines used to carry audio have an ac impedance of 600 ohms. The amplitude of signals is most conveniently measured in dBm. Zero dBm is equal to 1 milliwatt across 600 ohms. Most audio voltmeter, such as the Motorola Transistorized AC Voltmeter, are calibrated to read directly in dBm when measuring across a 600 ohm impedance. Never use a volt-ohmmeter or a multimeter.

Step 1. Apply a 1000 Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression. Adjust the output of the remote control console for +14 dBm (or maximum allowable audio level) at its output terminals.

Step 2. Adjust the XCTR LEVEL control (line driver module) so that the exciter audio input equals the value stamped on the exciter (modulator sensitivity plus 3 dB or approximately ±5 kHz transmitter deviation).

Step 3. Remove the 1000 Hz audio tone.

Step 4. Set the receiver SQUELCH control for squelch threshold.

Step 5. Inject a 1000 uV carrier frequency signal into the antenna input of the receiver. Modulate the signal with a 1000 Hz tone at ±5 kHz deviation.

Step 6. Adjust the LINE 1 OUTPUT (line driver module) for +11 dBm (3.9 V) or maximum allowable audio level as measured with an audio voltmeter across the line 1 terminals. If four-wire audio operation is used, with the receiver output applied to line 2, adjust the LINE 2 OUTPUT control while measuring across the line 2 terminals.

11.2.3 Special Procedure for Low Level Test Tone

NOTE

The following procedure is written for the 0 vu speech level and 0 dBm test tone level, but other levels may be used by substituting appropriate levels (levels across the 600-ohm load should be 6 dB higher than the specified line level).

Step 1. Terminate the remote control console in a 600 ohm load resistor rather than the line.

Step 2. Apply a 1000 Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression.

Step 3. Connect an audio voltmeter across the 600 ohm load resistor and adjust the line output for +6 dBm.

Step 4. Reduce the input 1000 Hz audio tone until the voltmeter reads 0 dBm.

Step 5. Remove the 600 ohm load resistor and reconnect the line. Readjust the line output for 0 dBm across the line. Do not change the input 1000 Hz tone level.

Step 6. Connect the audio voltmeter to the exciter audio input at the station and adjust the XCTR LEVEL control for 6 dB less than the value stamped on the exciter.

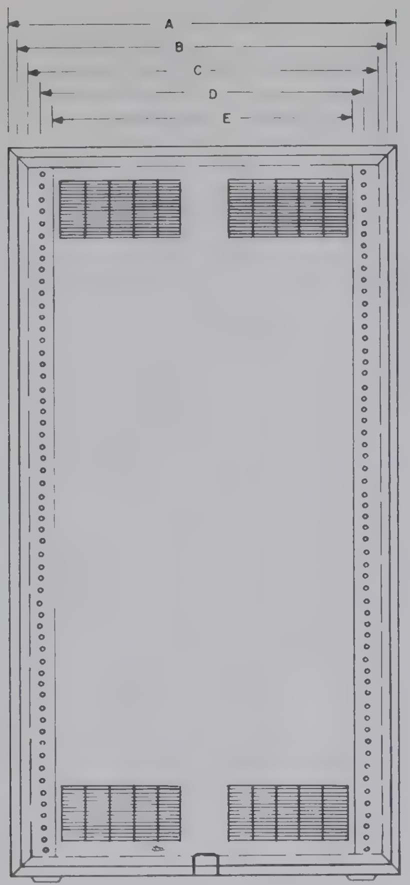
Step 7. Disconnect the line at the station and connect a 600 ohm load resistor in its place.

Step 8. Apply a 1000 uV carrier signal to the receiver antenna terminal from an FM signal generator. Modulate the carrier signal with a 1000 Hz tone at ±5 kHz deviation.

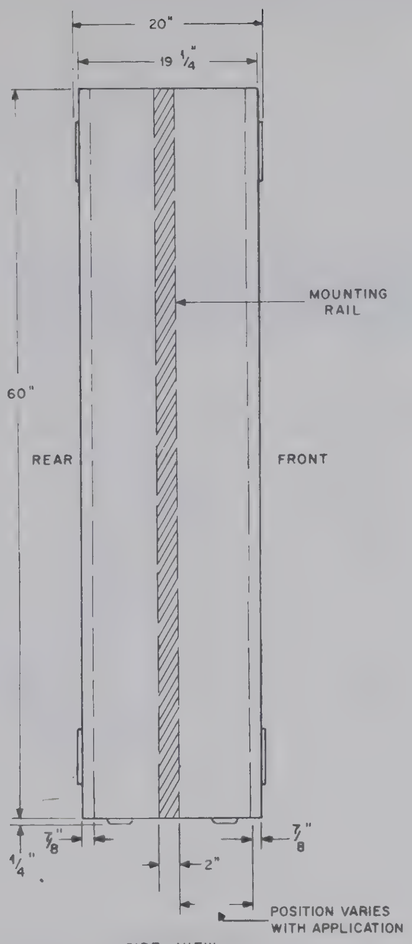
Step 9. Connect an audio voltmeter across the 600 ohm load resistor and adjust the LINE 1 OUTPUT control for +6 dBm.

Step 10. Reduce the deviation until the voltmeter reads 0 dBm.

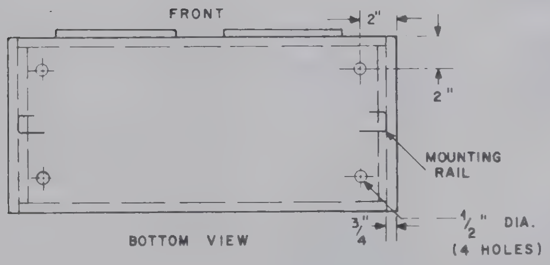
Step 11. Remove the 600 ohm load resistor and reconnect the line. Readjust the LINE 1 OUTPUT for 0 dBm as measured across the line.



REAR VIEW


20"
19 1/4"
MOUNTING RAIL
60"
REAR
FRONT
7/8"
1/4"
2"
7/8"
POSITION VARIES WITH APPLICATION

SIDE VIEW


FRONT
2"
2"
MOUNTING RAIL
3/4"
1/2" DIA.
(4 HOLES)

BOTTOM VIEW

A = 22" CABINET WIDTH
B = 20-1/2" DOOR OPENING
C = 19-3/16" CABINET OPENING
D = 18-5/16" MTG. HOLE CENTERS
E = 17-11/16" CLEARANCE BETWEEN RAILS

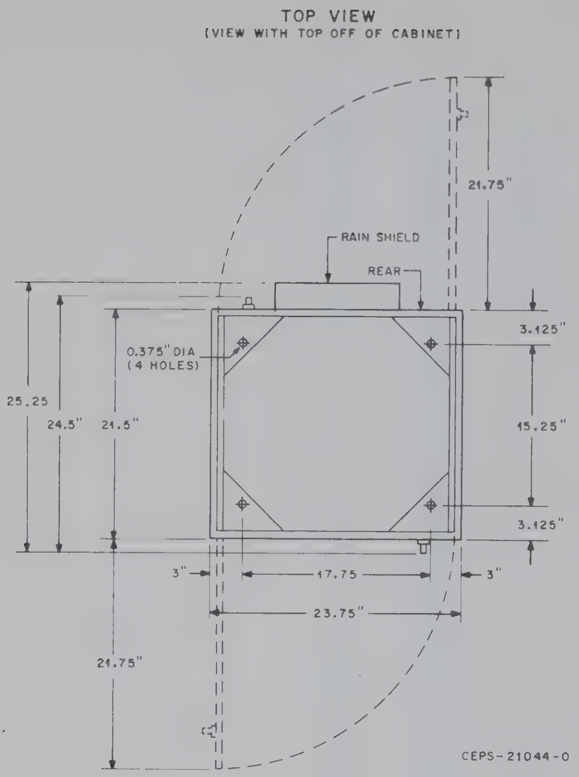
CEPS-17187-B

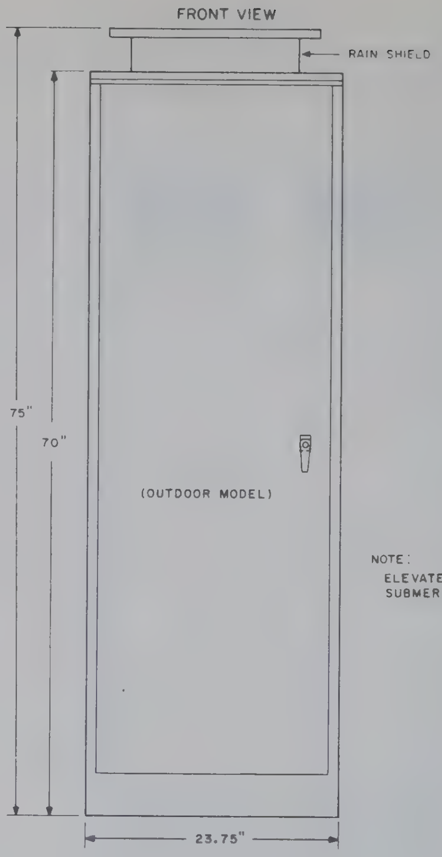
parts list

THN6304A Cabinet Kit (60-Inch) PL-4366-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	15-83445K04	CABINET (60-inch)
	13-84430D01	DOOR VENT (7 required)
	13-84430D04	DOOR VENT, HIGH TEMP (1 required)

THN6304A Cabinet (60 Inch Indoor)
Dimensional Detail and Parts List
Motorola No. PEPS-21129-A
12/1/82- UP


TOP VIEW
(VIEW WITH TOP OFF OF CABINET)
21.75"
RAIN SHIELD
REAR
3.125"
0.375" DIA
(4 HOLES)
25.25
24.5"
21.5"
15.25"
3.125"
3"
17.75
3"
23.75"
21.75"
CEPS-21044-0


FRONT VIEW
RAIN SHIELD
75"
70"
(OUTDOOR MODEL)
23.75"

NOTE:
ELEVATE CABINET IF DANGER OF WATER SUBMERSION EXISTS.

parts list

THN6203A Cabinet 75" PL-5150-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	15-82123H05	CABINET

TRN6720A Rain Shield Kit PL-5151-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	26-82929H01	SHIELD, rain (top)
	26-84084F01	SHIELD, cover (top)
	15-82926H01	COVER, rain shield
	32-82499L01	GASKET, rain shield
	32-82499L02	GASKET; rain shield
	32-84180G01	GASKET; 2 req'd.
	32-84180G02	GASKET; 2 req'd.
	2-10080A03	NUT, spring: No. 8; 4 req'd.
	3-9661	SCREW, machine: 8-32 × 3/8"; 8 req'd.
	3-132823	SCREW, tapping: 8-18 × 3/8"; 4 req'd.
	3-135014	SCREW, tapping: 8-18 × 1/2"; 6 req'd.
	15-82433L01	HOOD, door vent

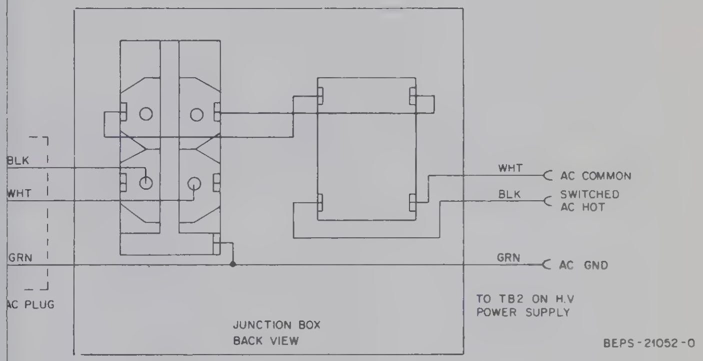
THN6203A Cabinet (75 Inch Outdoor)
Dimensional Detail and Parts List
Motorola No. ***PEPS-21043-A***
12/1/82- UP

POWER JUNCTION BOX

MODELS TRN6587A (60'' INDOOR) AND TRN5695A (75'' OUTDOOR) OPTIONAL

FUNCTION

Provides ac power inputs to the station.


BLK
WHT
GRN
AC PLUG
JUNCTION BOX
BACK VIEW
WHT
AC COMMON
BLK
SWITCHED
AC HOT
GRN
AC GND
TO TB2 ON H.V
POWER SUPPLY
BEPS-21052-0

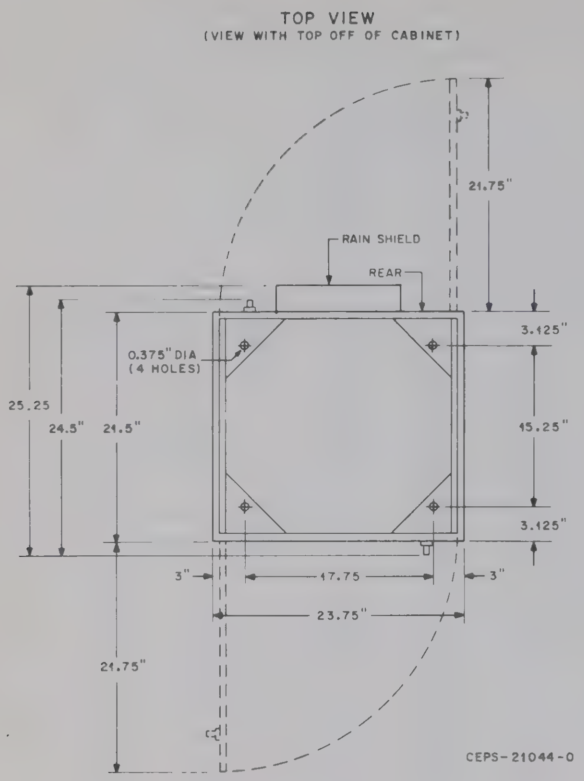
parts list

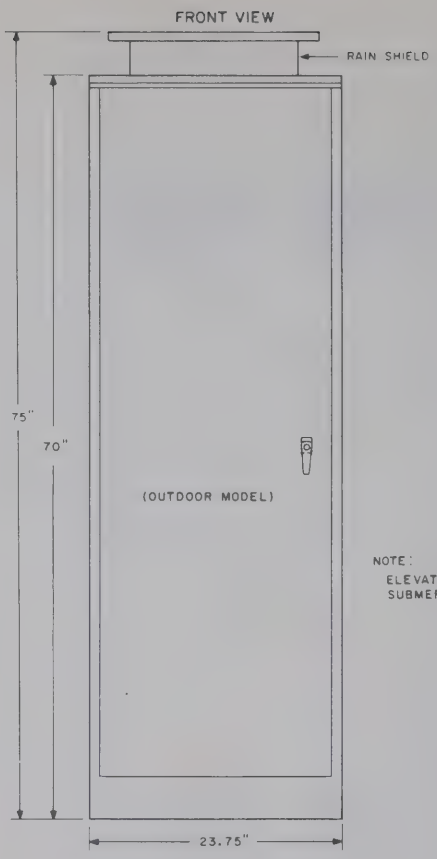
TRN6587A and TRN5695A Junction Box PL-4383-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1	9-891865	**connector, receptacle:** dual ac outlet
P1		**connector, plug:** part of W1
S1	40-82041K01	**switch, toggle:** dpst
W1	30-83849E01	**cable:** ac line cord: includes refer P1 (TRN6587A only)
		mechanical parts
	7-84617H01	BOX, outlet
	15-82025K01	COVER, box; outlet
	29-824154	LUG for #10 lead (TRN6587A only)
	29-845081	LUG for #8 lead (TRN6587A only)
	42-84618H01	CLAMP, cord; 2 req'd.
	64-82314L01	PLATE (TRN6587A only)
	1-80762B68	LEAD ASSEMBLY (GRY-GRN) includes:
	29-848901	LUG, solderless; 2 req'd.
	1-80762B69	LEAD ASSEMBLY (WHT) includes:
	29-848901	LUG, solderless; 2 req'd.
	1-80762B70	LEAD ASSEMBLY includes:
	29-847854	LUG, slotted tongue
	29-848902	LUG, solderless; 4 req'd.

INSTALLATION & INITIAL ADJUSTMENTS

Motorola No. PEPS-21053-A
12/1/82- UP


TOP VIEW
(VIEW WITH TOP OFF OF CABINET)
21.75"
RAIN SHIELD
REAR
3.125"
0.375" DIA
(4 HOLES)
25.25
24.5"
21.5"
15.25"
3.125"
3"
17.75
3"
23.75"
21.75"
CEPS-21044-0


FRONT VIEW
RAIN SHIELD
75"
70"
(OUTDOOR MODEL)
23.75"

NOTE:
ELEVATE CABINET IF DANGER OF WATER SUBMERSION EXISTS.

parts list

THN6203A Cabinet 75" PL-5150-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	15-82123H05	CABINET

TRN6720A Rain Shield Kit PL-5151-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	26-82929H01	SHIELD, rain (top)
	26-84084F01	SHIELD, cover (top)
	15-82926H01	COVER, rain shield
	32-82499L01	GASKET, rain shield
	32-82499L02	GASKET; rain shield
	32-84180G01	GASKET; 2 req'd.
	32-84180G02	GASKET; 2 req'd.
	2-10080A03	NUT, spring: No. 8; 4 req'd.
	3-9661	SCREW, machine: 8-32 × 3/8"; 8 req'd.
	3-132823	SCREW, tapping: 8-18 × 3/8"; 4 req'd.
	3-135014	SCREW, tapping: 8-18 × 1/2"; 6 req'd.
	15-82433L01	HOOD, door vent

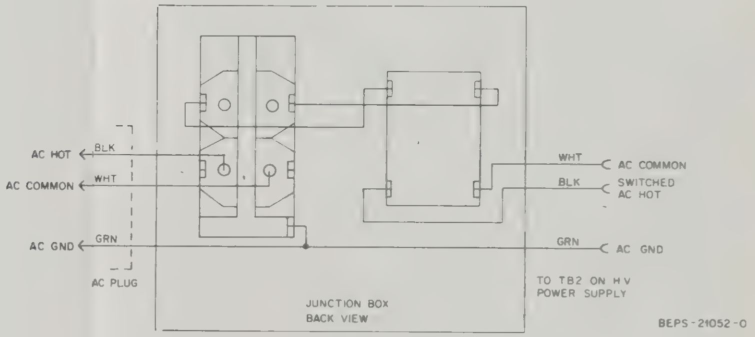
THN6203A Cabinet (75 Inch Outdoor)
Dimensional Detail and Parts List
Motorola No. ***PEPS-21043-A***
12/1/82- UP

POWER JUNCTION BOX

MODELS TRN6587A (60'' INDOOR) AND TRN5695A (75'' OUTDOOR) OPTIONAL

FUNCTION

Provides ac power inputs to the station.


AC HOT
BLK
AC COMMON
WHT
AC GND
GRN
AC PLUG
JUNCTION BOX
BACK VIEW
WHT
AC COMMON
BLK
SWITCHED
AC HOT
GRN
AC GND
TO TB2 ON HV
POWER SUPPLY
BEPS-21052-0

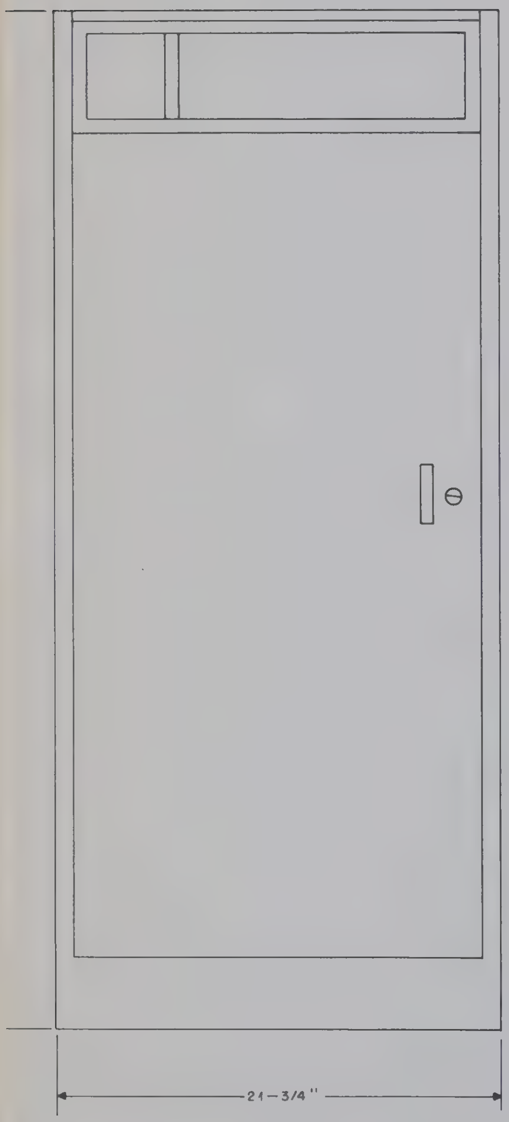
parts list

TRN6587A and TRN5695A Junction Box PL-4383-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1	9-891865	**connector, receptacle:** dual ac outlet
P1		**connector, plug:** part of W1
S1	40-82041K01	**switch, toggle:** dpst
W1	30-83849E01	**cable:** ac line cord: includes refer P1 (TRN6587A only)
		mechanical parts
	7-84617H01	BOX, outlet
	15-82025K01	COVER, box; outlet
	29-824154	LUG for #10 lead (TRN6587A only)
	29-845081	LUG for #8 lead (TRN6587A only)
	42-84618H01	CLAMP, cord; 2 req'd.
	64-82314L01	PLATE (TRN6587A only)
	1-80762B68	LEAD ASSEMBLY (GRY-GRN) includes:
	29-848901	LUG, solderless; 2 req'd.
	1-80762B69	LEAD ASSEMBLY (WHT) includes:
	29-848901	LUG, solderless; 2 req'd.
	1-80762B70	LEAD ASSEMBLY includes:
	29-847854	LUG, slotted tongue
	29-848902	LUG, solderless; 4 req'd.

Motorola No. PEPS-21053-A
12/1/82- UP

FRONT VIEW



NOTES:

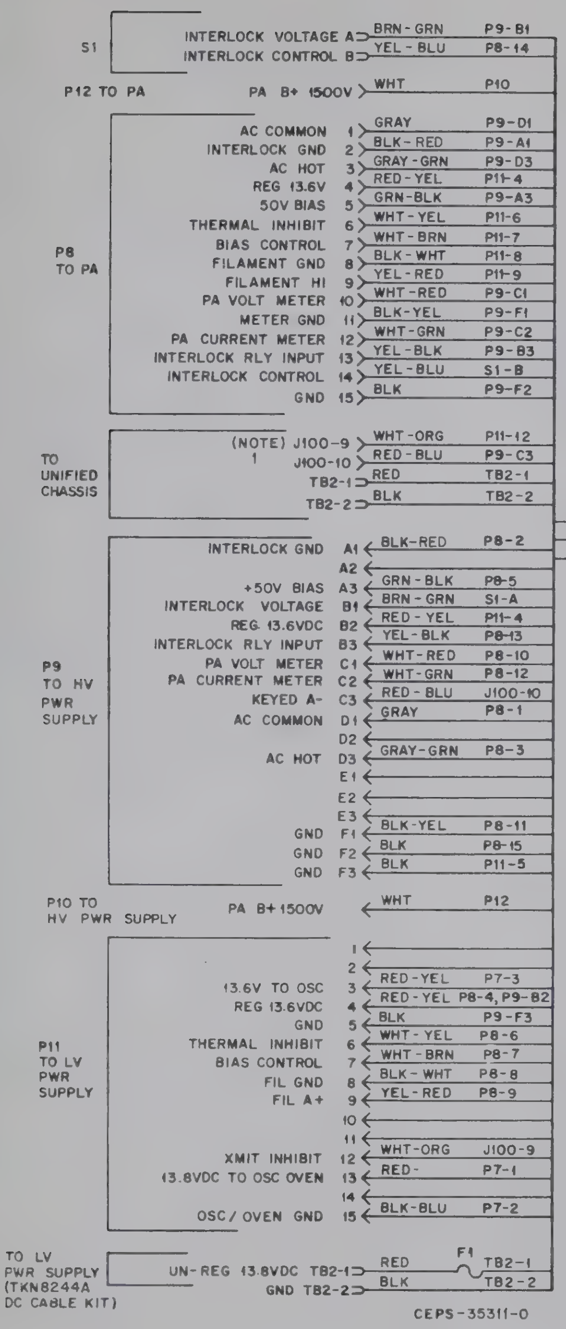
1. FRONT AND REAR DOORS CAN BE REVERSED FROM RIGHT HAND OPENING TO LEFT HAND OPENING.
2. ON REAR DOOR, UPPER AIR DUCT OPENING MUST BE UNCOVERED AND BOTTOM AIR DUCT OPENING COVERED.
3. ELEVATE CABINET IF DANGER OF WATER SUBMERSION EXISTS.

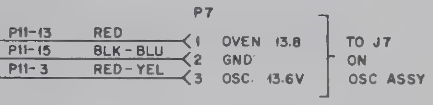
STATION CABLE KIT

MODEL TKN8212A

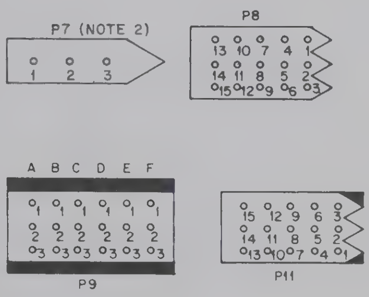
FUNCTION

Provides interconnections between transmitter boards.


S1
INTERLOCK VOLTAGE A BRN-GRN P9-B1
INTERLOCK CONTROL B YEL-BLU P8-14
P12 TO PA
PA B+ 1500V WHT P10
P8 TO PA
AC COMMON 1 GRAY P9-D1
INTERLOCK GND 2 BLK-RED P9-A1
AC HOT 3 GRAY-GRN P9-D3
REG 13.6V 4 RED-YEL P11-4
50V BIAS 5 GRN-BLK P9-A3
THERMAL INHIBIT 6 WHT-YEL P11-6
BIAS CONTROL 7 WHT-BRN P11-7
FILAMENT GND 8 BLK-WHT P11-8
FILAMENT HI 9 YEL-RED P11-9
PA VOLT METER 10 WHT-RED P9-C1
METER GND 11 BLK-YEL P9-F1
PA CURRENT METER 12 WHT-GRN P9-C2
INTERLOCK RLY INPUT 13 YEL-BLK P9-B3
INTERLOCK CONTROL 14 YEL-BLU S1-B
GND 15 BLK P9-F2
TO UNIFIED CHASSIS
(NOTE) 1 J100-9 WHT-ORG P11-12
J100-10 RED-BLU P9-C3
TB2-1 RED TB2-1
TB2-2 BLK TB2-2
P9 TO HV PWR SUPPLY
INTERLOCK GND A1 BLK-RED P8-2
A2
+50V BIAS A3 GRN-BLK P8-5
INTERLOCK VOLTAGE B1 BRN-GRN S1-A
REG 13.6VDC B2 RED-YEL P11-4
INTERLOCK RLY INPUT B3 YEL-BLK P8-13
PA VOLT METER C1 WHT-RED P8-10
PA CURRENT METER C2 WHT-GRN P8-12
KEYED A- C3 RED-BLU J100-10
AC COMMON D1 GRAY P8-1
D2
AC HOT D3 GRAY-GRN P8-3
E1
E2
E3
GND F1 BLK-YEL P8-11
GND F2 BLK P8-15
GND F3 BLK P11-5
P10 TO HV PWR SUPPLY
PA B+ 1500V WHT P12
P11 TO LV PWR SUPPLY
1
2
13.6V TO OSC 3 RED-YEL P7-3
REG 13.6VDC 4 RED-YEL P8-4, P9-B2
GND 5 BLK P9-F3
THERMAL INHIBIT 6 WHT-YEL P8-6
BIAS CONTROL 7 WHT-BRN P8-7
FIL GND 8 BLK-WHT P8-8
FIL A+ 9 YEL-RED P8-9
10
11
XMIT INHIBIT 12 WHT-ORG J100-9
13.8VDC TO OSC OVEN 13 RED- P7-1
14
OSC/OVEN GND 15 BLK-BLU P7-2
TO LV PWR SUPPLY (TKN8244A DC CABLE KIT)
UN-REG 13.8VDC TB2-1 RED F1 TB2-1
GND TB2-2 BLK TB2-2
CEPS-35311-O


P7
P11-13 RED 1 OVEN 13.8
P11-15 BLK-BLU 2 GND
P11-3 RED-YEL 3 OSC. 13.6V
TO J7 ON OSC ASSY

NOTE:
1) CONNECTS TO J100-8 ON COMMUNITY RPTR.
2) P7 VIEWED FROM EXPOSED TERMINAL SIDE.


P7 (NOTE 2)
1 2 3
P8
13 10 7 4 1
14 11 8 5 2
15 12 9 6 3
A B C D E F
1 1 1 1 1 1
2 2 2 2 2 2
3 3 3 3 3 3
P9
15 12 9 6 3
14 11 8 5 2
13 10 7 4 1
P11

parts list

TKN8244A Cable Fuse PL-8316-O

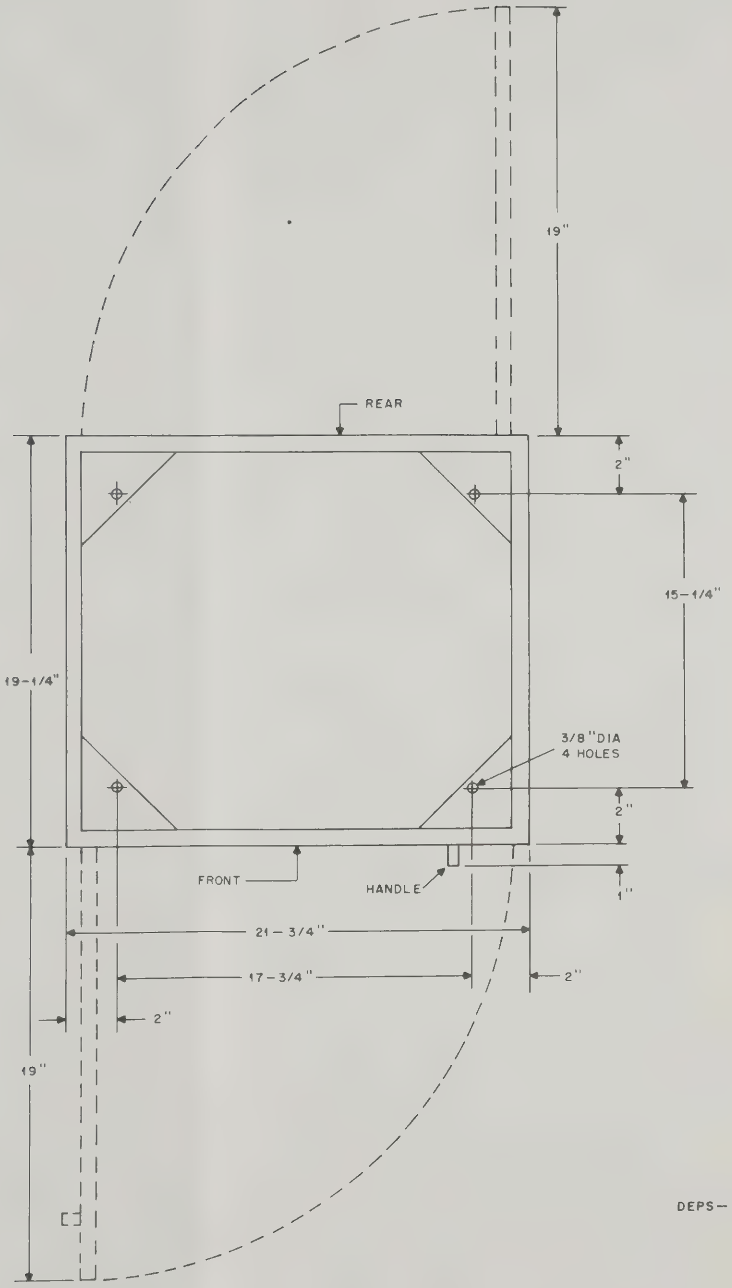
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fuse:
F1	65-10266	10 amp; 32 V
		mechanical parts
	14-82882A01	BODY, fuseholder
	14-82883A01	CAP, fuseholder
	29-848902	LUG, crimp terminal; 2 used
	29-84078B01	LUG, spade; 2 used
	41-82885A01	SPRING, fuse
	42-10217A02	STRAP, tie; 8 used
	42-82884A01	CLIP, fuse; 2 used

parts list

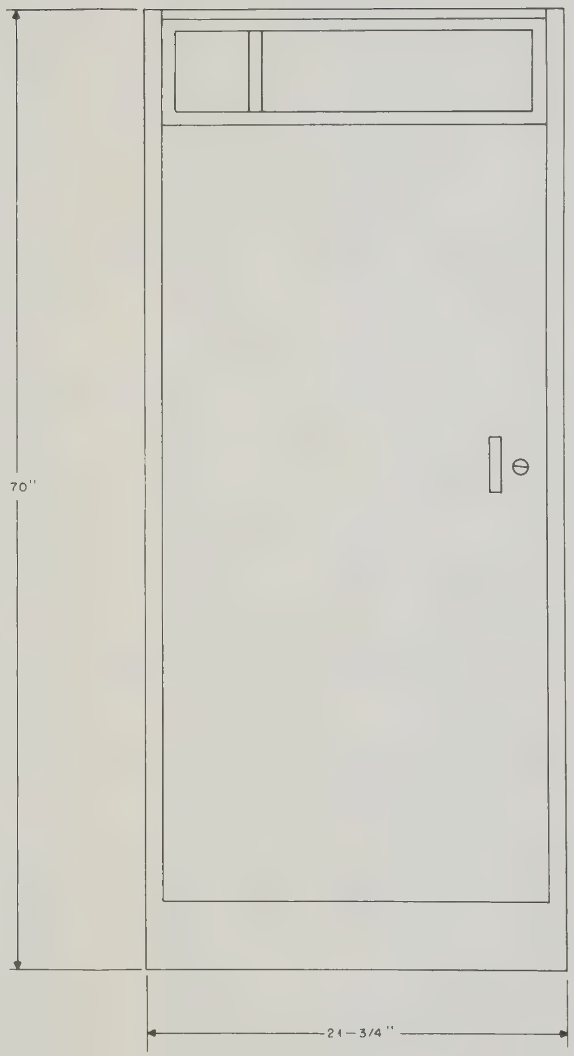
TKN8212A Station Cable Kit PL-8190-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
		includes:
P7	15-10183B09	HOUSING, 3-contact
	29-84706E06	CONTACT, male; 3 used
P8		includes:
	14-82834H03	INSULATOR; 15-contact
	29-82335A07	CONTACT, female; 15 used
P9		includes:
	14-82337A07	INSULATOR, 11-contact
	29-82335A01	CONTACT, male; 11-contact
	29-82336A01	CONTACT, female; 2 used
P11		includes:
	14-82836H01	INSULATOR; 15-contact
	29-82335A01	CONTACT, male; 10 used
		mechanical parts
	29-83883C06	LUG, soldering; 2 used
	29-84706E06	TERMINAL, crimp socket; 3 used
	30-82905H01	CABLE, high voltage; includes: P10 and P12
	39-10184A24	CONTACT, receptacle; 2 used
	42-10217A02	STRAP, tie (.091 × 3.62 WHT); 27 used
	42-10217A10	STRAP, tie (0.184 × 7.78 WHT); 3 used

TOP VIEW
(VIEW WITH TOP OFF OF CABINET)


19"
REAR
2"
15-1/4"
19-1/4"
3/8"DIA
4 HOLES
2"
FRONT
HANDLE
1"
21 - 3/4"
17-3/4"
2"
2"
19"

FRONT VIEW



NOTES

1. FRONT AND REAR DOORS CAN BE REVERSED FROM RIGHT HAND OPENING TO LEFT HAND OPENING.
2. ON REAR DOOR, UPPER AIR DUCT OPENING MUST BE UNCOVERED AND BOTTOM AIR DUCT OPENING COVERED
3. ELEVATE CABINET IF DANGER OF WATER SUBMERSION EXISTS

DEPS-15048-B

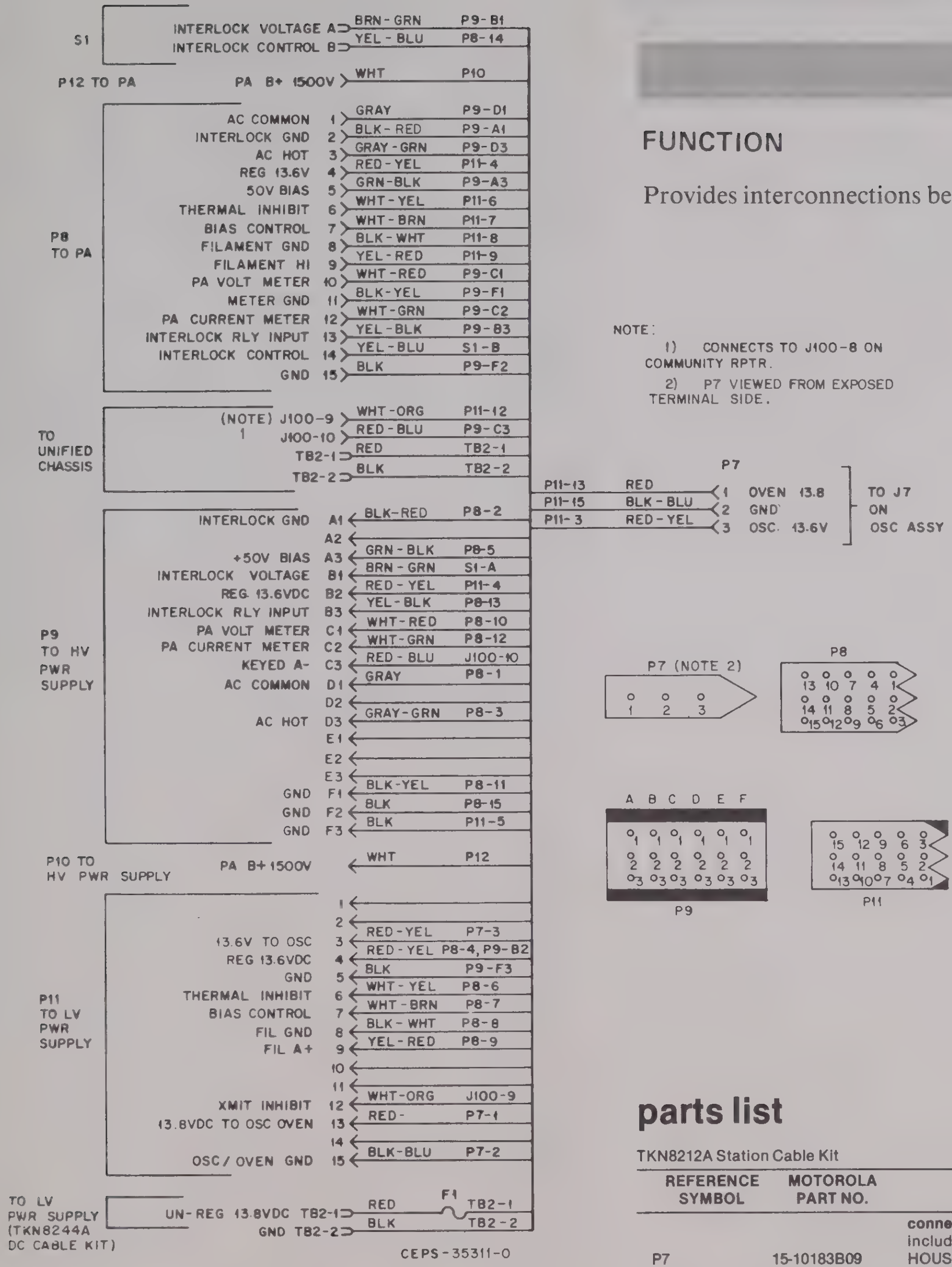
THN6316A (70" Indoor Cabinet)
Dimensional Detail
Motorola No. ***DEPS-15048-B***
12/1/82- UP

STATION CABLE KIT

MODEL TKN8212A

FUNCTION

Provides interconnections between transmitter boards.


S1
INTERLOCK VOLTAGE A — BRN-GRN — P9-B1
INTERLOCK CONTROL B — YEL-BLU — P8-14
P12 TO PA
PA B+ 1500V — WHT — P10
P8 TO PA
AC COMMON 1 — GRAY — P9-D1
INTERLOCK GND 2 — BLK-RED — P9-A1
AC HOT 3 — GRAY-GRN — P9-D3
REG 13.6V 4 — RED-YEL — P11-4
50V BIAS 5 — GRN-BLK — P9-A3
THERMAL INHIBIT 6 — WHT-YEL — P11-6
BIAS CONTROL 7 — WHT-BRN — P11-7
FILAMENT GND 8 — BLK-WHT — P11-8
FILAMENT HI 9 — YEL-RED — P11-9
PA VOLT METER 10 — WHT-RED — P9-C1
METER GND 11 — BLK-YEL — P9-F1
PA CURRENT METER 12 — WHT-GRN — P9-C2
INTERLOCK RLY INPUT 13 — YEL-BLK — P9-B3
INTERLOCK CONTROL 14 — YEL-BLU — S1-B
GND 15 — BLK — P9-F2
TO UNIFIED CHASSIS
(NOTE) 1 J100-9 — WHT-ORG — P11-12
J100-10 — RED-BLU — P9-C3
TB2-1 — RED — TB2-1
TB2-2 — BLK — TB2-2
P11-13 — RED — 1 OVEN 13.8
P11-15 — BLK-BLU — 2 GND
P11-3 — RED-YEL — 3 OSC. 13.6V
P7
TO J7 ON OSC ASSY
P9 TO HV PWR SUPPLY
INTERLOCK GND A1 — BLK-RED — P8-2
A2
+50V BIAS A3 — GRN-BLK — P8-5
INTERLOCK VOLTAGE B1 — BRN-GRN — S1-A
REG 13.6VDC B2 — RED-YEL — P11-4
INTERLOCK RLY INPUT B3 — YEL-BLK — P8-13
PA VOLT METER C1 — WHT-RED — P8-10
PA CURRENT METER C2 — WHT-GRN — P8-12
KEYED A- C3 — RED-BLU — J100-10
AC COMMON D1 — GRAY — P8-1
D2
AC HOT D3 — GRAY-GRN — P8-3
E1
E2
E3
GND F1 — BLK-YEL — P8-11
GND F2 — BLK — P8-15
GND F3 — BLK — P11-5
P10 TO HV PWR SUPPLY
PA B+ 1500V — WHT — P12
P11 TO LV PWR SUPPLY
1
2
13.6V TO OSC 3 — RED-YEL — P7-3
REG 13.6VDC 4 — RED-YEL — P8-4, P9-B2
GND 5 — BLK — P9-F3
THERMAL INHIBIT 6 — WHT-YEL — P8-6
BIAS CONTROL 7 — WHT-BRN — P8-7
FIL GND 8 — BLK-WHT — P8-8
FIL A+ 9 — YEL-RED — P8-9
10
11
XMIT INHIBIT 12 — WHT-ORG — J100-9
13.8VDC TO OSC OVEN 13 — RED- — P7-1
14
OSC/OVEN GND 15 — BLK-BLU — P7-2
TO LV PWR SUPPLY (TKN8244A DC CABLE KIT)
UN-REG 13.8VDC TB2-1 — RED — F1 — TB2-1
GND TB2-2 — BLK — TB2-2
CEPS-35311-O
P7 (NOTE 2)
1 2 3
P8
13 10 7 4 1
14 11 8 5 2
15 12 9 6 3
A B C D E F
1 1 1 1 1 1
2 2 2 2 2 2
3 3 3 3 3 3
P9
15 12 9 6 3
14 11 8 5 2
13 10 7 4 1
P11

NOTE:
1) CONNECTS TO J100-8 ON COMMUNITY RPTR.
2) P7 VIEWED FROM EXPOSED TERMINAL SIDE.

parts list

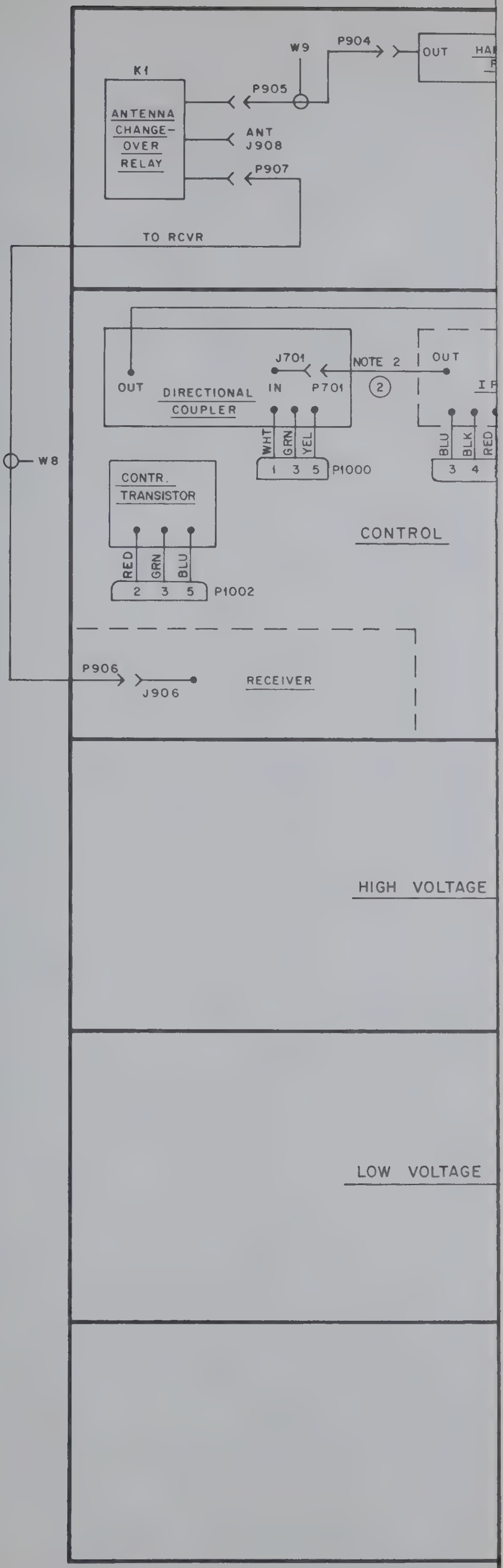
TKN8244A Cable Fuse PL-8316-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		fuse:
F1	65-10266	10 amp; 32 V
		mechanical parts
	14-82882A01	BODY, fuseholder
	14-82883A01	CAP, fuseholder
	29-848902	LUG, crimp terminal; 2 used
	29-84078B01	LUG, spade; 2 used
	41-82885A01	SPRING, fuse
	42-10217A02	STRAP, tie; 8 used
	42-82884A01	CLIP, fuse; 2 used

parts list

TKN8212A Station Cable Kit PL-8190-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, plug:
		includes:
P7	15-10183B09	HOUSING, 3-contact
	29-84706E06	CONTACT, male; 3 used
P8		includes:
	14-82834H03	INSULATOR; 15-contact
	29-82335A07	CONTACT, female; 15 used
P9		includes:
	14-82337A07	INSULATOR, 11-contact
	29-82335A01	CONTACT, male; 11-contact
	29-82336A01	CONTACT, female; 2 used
P11		includes:
	14-82836H01	INSULATOR; 15-contact
	29-82335A01	CONTACT, male; 10 used
		mechanical parts
	29-83883C06	LUG, soldering; 2 used
	29-84706E06	TERMINAL, crimp socket; 3 used
	30-82905H01	CABLE, high voltage; includes: P10 and P12
	39-10184A24	CONTACT, receptacle; 2 used
	42-10217A02	STRAP, tie (.091 × 3.62 WHT); 27 used
	42-10217A10	STRAP, tie (0.184 × 7.78 WHT); 3 used



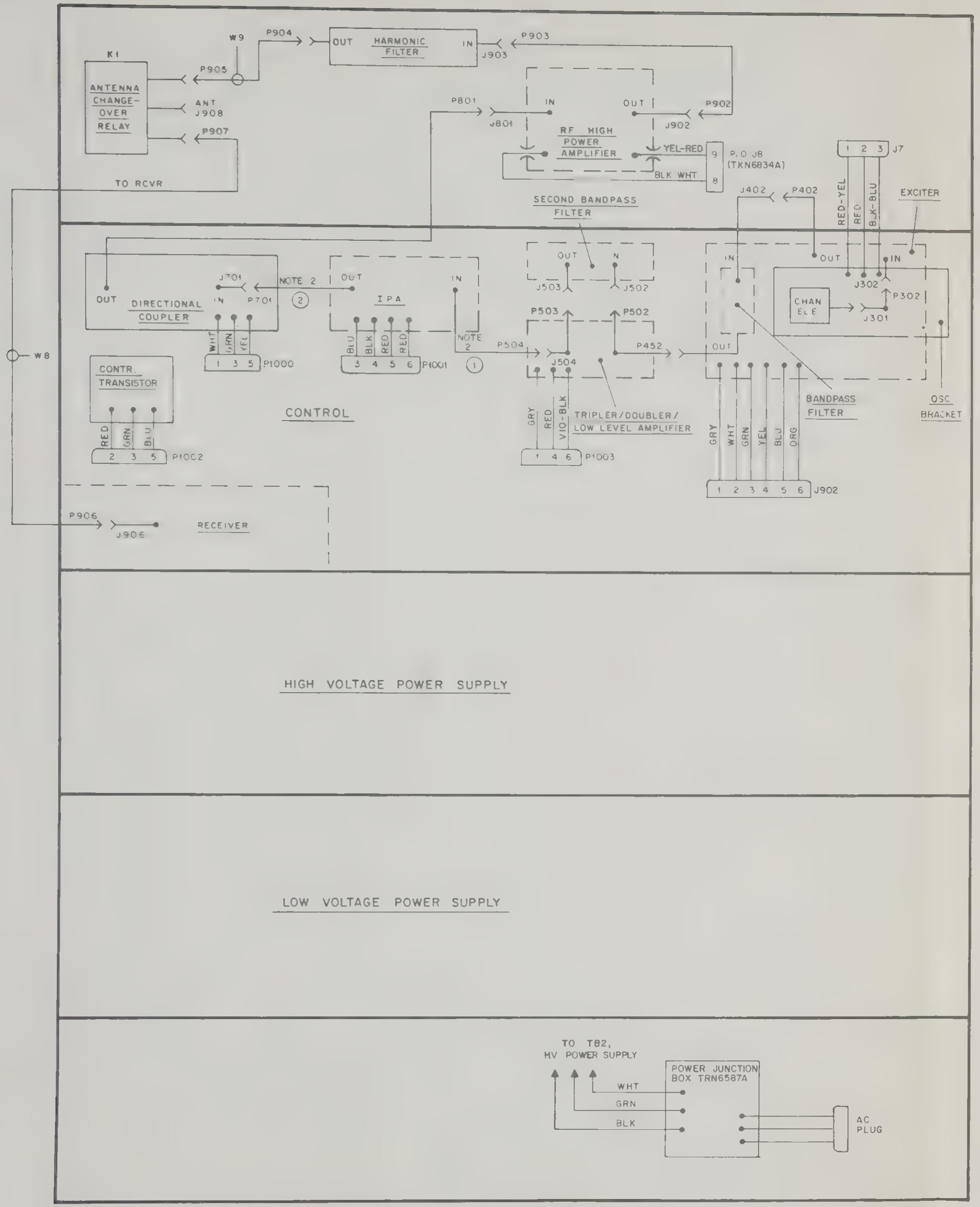
W9
P904
OUT
K1
P905
ANTENNA CHANGE-OVER RELAY
ANT
J908
P907
TO RCVR
J701
NOTE 2
OUT
OUT
DIRECTIONAL COUPLER
IN
P701
②
WHT
GRN
YEL
1 3 5
P1000
BLU
BLK
RED
3 4
W8
CONTR. TRANSISTOR
CONTROL
RED
GRN
BLU
2 3 5
P1002
P906
J906
RECEIVER
HIGH VOLTAGE
LOW VOLTAGE

STATION RACKING DIAGRAM CABLING DETAIL & STATION HARDWARE KIT

MODEL TRN4846A

Motorola No. PEPS-35500-O
12/1/82-UP

STATION RACKING DIAGRAM
CABLING DETAIL
& STATION HARDWARE KIT
MODEL TRN4846A

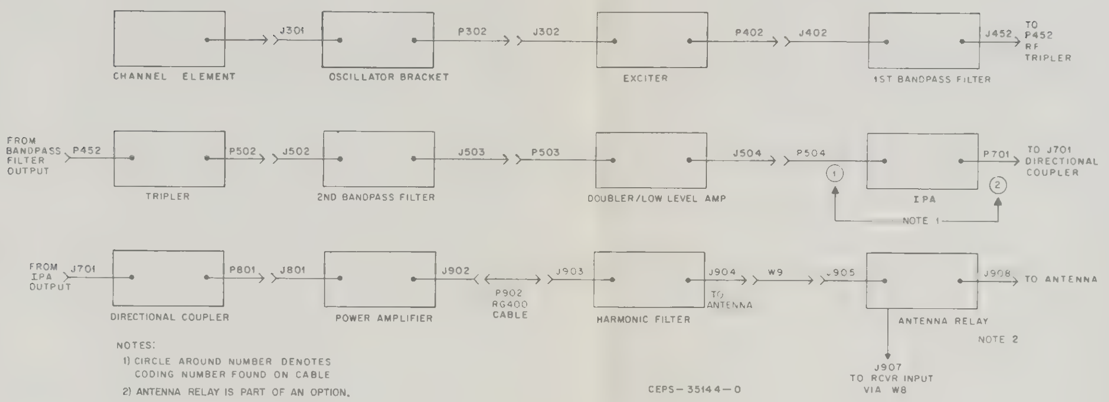

K1
ANTENNA CHANGE-OVER RELAY
W9
P904
P905
ANT J908
P907
TO RCVR
OUT
HARMONIC FILTER
IN
J903
P903
P801
J801
IN
OUT
RF HIGH POWER AMPLIFIER
J902
P902
YEL-RED
BLK WHT
9
8
P.O. J8 (TKN6834A)
J7
1 2 3
RED-YEL
RED
BLK-BLU
EXCITER
J402
P402
SECOND BANDPASS FILTER
OUT
IN
J503
J502
P503
P502
P452
P504
J504
OUT
DIRECTIONAL COUPLER
J701
P701
NOTE 2
②
IPA
NOTE 2
①
WHT GRN YEL
1 3 5
P1000
BLU BLK RED RED
3 4 5 6
P1001
W8
CONTR. TRANSISTOR
RED GRN BLU
2 3 5
P1002
CONTROL
GRY RED VIO-BLK
1 4 6
P1003
TRIPLER/DOUBLER/LOW LEVEL AMPLIFIER
CHAN ELE
J302
P302
J301
BANDPASS FILTER
OSC BRACKET
GRY WHT GRN YEL BLU ORG
1 2 3 4 5 6
J902
P906
J906
RECEIVER
HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY
TO TB2, HV POWER SUPPLY
POWER JUNCTION BOX TRN6587A
WHT
GRN
BLK
AC PLUG

DEPS—35138—0

NOTES

1. RELAY K1 AND CABLE W8 ARE P O ANTENNA CHANGEOVER OPTION
2. CIRCLED NUMBERS INDICATE NUMBERS FOUND ON COAXIAL CABLES

STATION RF CABLE KIT WIRING DIAGRAM


CHANNEL ELEMENT
J301
OSCILLATOR BRACKET
P302
J302
EXCITER
P402
J402
1ST BANDPASS FILTER
J452
TO P452 RF TRIPLER
FROM BANDPASS FILTER OUTPUT
P452
TRIPLER
P502
J502
2ND BANDPASS FILTER
J503
P503
DOUBLER/LOW LEVEL AMP
J504
P504
①
IPA
P701
②
TO J701 DIRECTIONAL COUPLER
NOTE 1
FROM IPA OUTPUT
J701
DIRECTIONAL COUPLER
P801
J801
POWER AMPLIFIER
J902
P902 RG400 CABLE
J903
HARMONIC FILTER
J904
TO ANTENNA
W9
J905
ANTENNA RELAY
J908
TO ANTENNA
NOTE 2
J907 TO RCVR INPUT VIA W8

NOTES:
1) CIRCLE AROUND NUMBER DENOTES CODING NUMBER FOUND ON CABLE
2) ANTENNA RELAY IS PART OF AN OPTION.

CEPS—35144—0

parts list

TRN4846A Hardware Station (125 W) PL-8205-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		switch:
S1	40-84188A01	Interlock
		non-referenced items
	2-119913	NUT, 8-32 x 11/32 x 1/8"; 3 used
	2-82360B34	NUT, speed; 1/4 x 14; 34 used
	3-7506	SCREW, tapping; 6-20 x 1/4"; 2 used
	3-8031	SCREW, machine: 6-32 x 1/4"; 2 used
	3-122777	SCREW, machine: 8-32 x 1/2"; 3 used
	3-134169	SCREW, tapping; 4-40 x 1/4"; 2 used
	3-135038	SCREW, tapping; 14 x 14 x 3/8"; 34 used
	3-138162	SCREW, tapping; 4-40 x 3/8"; 2 used
	3-139495	SCREW, tapping; 6-32 x 5/16"; 2 used
	3-139564	SCREW, cap; 3/8-24 x 1/2"; 2 used
	4-7668	LOCKWASHER, 3/8" external; 2 used
	7-82317L01	BRACKET
	7-83849N01	BRACKET, rack mounting; 2 used
	13-813618	DECAL, patent no.
	14-82903K01	INSULATOR
	26-82911K01	HEAT SINK
	33-84215K03	NAMEPLATE
	42-10217A02	STRAP, tie; .091 x 3.62" WHT; 5 used
	42-10217A10	STRAP, tie; .184 x 7.78; 3 used
	42-84284B01	RETAINER; 2 used
	54-83040C01	LABEL, audio
	54-84126C01	LABEL, replacement parts
	54-84857B01	LABEL, wattmeter
	55-84300B01	HANDLE; 4 used
	55-84300B02	HANDLE
	66-106515	WRENCH, Allen
	66-82186E01	TOOl, align.
	26-84981F01	SHIELD
	42-10113A26	RETAINER, ring; 12 used
	46-84090C01	STUD, retainer; 16 used
	26-84053E01	SHIELD and insert
	26-84053E04	INSERT
	26-84278G01	SHIELD, AGC screened
	2-10101A53	NUT, spring; 4 used
	7-82641L02	BRACKET
	45-82642L01	LEVER
	7-82785K02	BRACKET, heat sink
	26-83820K04	SHIELD
	40-84188A01	SWITCH

Motorola No. PEPS-35500-O
12/1/82- UP

MOTOROLA INC.
Communications
Sector

STATION MAINTENANCE

1. INTRODUCTION

This section of the manual describes local operation techniques required to perform maintenance checks. Overall station maintenance is detailed in this section while specific chassis maintenance (transmitter, receiver or power supply, etc.) is provided with the applicable section. Maintenance checks for control modules are given with the applicable module in separate Control and Applications Instruction Manual 68P81060E70.

2. LOCAL OPERATION FOR TESTING & MAINTENANCE

NOTE

When ac power to the station is turned on, the transmitter is inhibited by the filament regulator board for approximately 68 seconds. The disable light on the station control module is illuminated during this period. In addition, the synthesizer requires 20 minutes to lock on frequency from initial ac power on.

2.1 Once power is applied and the station is properly adjusted, the station is normally operated entirely unattended from a remote control point. However, the station may be locally operated utilizing controls on control modules in the unified chassis. This type of operation may be necessary to accomplish station maintenance and testing.

2.2 Local operation of the station is primarily accomplished utilizing controls on the station control module located in the unified chassis. The controls and functions are listed in the Station Control Module Controls Table.

WARNING

The transmitter can be keyed remotely. To prevent unexpected transmitter keying while servicing the station, be sure the LINE DISABLE switch is actuated (direction of arrow).

Station Control Module Controls

Control	Position	Functions Possible
XMIT	Normal (not actuated)	Normal mode of operation.
	Actuated (hold-to-right)	Turns on transmitter with no modulation. Use test microphone connected to Local Mic receptacle to modulate transmitter.
PL DISABLE* (functional only in *Private-Line* stations)	Normal (left)	Only PL tone-coded on-frequency signals accepted by receiver.
	Actuated (right)	All on-frequency signals accepted by receiver.
LINE DISABLE*	Normal (left)	Transmitter can be operated by: 1. XMIT switch 2. Local microphone 3. Remote control console
	Actuated (right)	Transmitter *cannot* be operated by remote control console over control line.

* The DISABLE LIGHT is illuminated when the LINE DISABLE or PL DISABLE switch is actuated.

2.3 The following are procedures pertaining to the local operation of a remotely controlled station or repeater station.

2.3.1 Transmitter Control

To prevent the transmitter from being keyed remotely, set station control module LINE DISABLE switch in the direction of the arrow. At conclusion of local operation, insure that the LINE DISABLE switch is returned to its normal position (opposite direction of the arrow).

2.3.2 Local Microphone

2.3.2.1 Stations With Built-In Metering

Connect a Motorola Model (TMN6071A) microphone, or equivalent to the MICROPHONE receptacle on the metering chassis.

2.3.3 Local Speaker

2.3.3.1 Stations Without Built-In Metering

Connect any 8 ohm, 10 watt test speaker to J4, pins 1 and 12 on the unified chassis interconnect board. This speaker is used to monitor all received messages. A Motorola *Micor* speaker (Models TSN6016A or B, TSN6020A) plugs directly into these pins without requiring any adapter.

2.3.3.2 Stations With Built-In Metering

Place the SPEAKER ON-OFF switch to the ON position.

2.3.4 Portable Test Set (For Stations Without Built-In Metering

A Motorola S1056-S1059 Series Portable Test Set with TEK-37 or TEK-37A Adapter Cable can be used as a local control facility. Connect the red "control" plug of the adapter cable to the metering receptacle (J3) on the unified chassis interconnect board. The speaker in the test set can be used for monitoring received signals and a microphone (Model TMN6071A) connected to the microphone receptacle on the test set can be used for originating transmissions. The XMIT button on the test set can be used to key the transmitter without voice modulation.

2.3.5 Received Audio

After the local speaker is turned on or connected, the station is ready to receive audio. The receiver PL feature, if used, can be defeated by setting the station control module PL DISABLE switch in the direction of the arrow. (At the conclusion of local operation, insure that the PL DISABLE switch is returned to its normal position.) If necessary, the receiver can be unsquelched utilizing the receiver SQUELCH control on the receiver chassis. The VOLUME control on the receiver chassis sets the audio output level of the local speaker.

2.3.6 Transmitting

NOTE

Before initiating any local transmissions, monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module XMIT switch or activating the push-to-talk microphone switch. Voice is transmitted using the local microphone.

2.3.7 Concluding Local Operation

At the conclusion of local operation, perform the following operations and checks to insure that the station is ready for remote operation.

Step 1. Reset receiver squelch level per procedures in the Receiver Section in the 68P81063E10 Receiver manual.

Step 2. Insure that station control module switches are positioned for normal operation.

Step 3. Disconnect microphone and test speaker (if used).

Step 4. Set all external power switches ON.

Step 5. Insure that station is operable from remote location.

Step 6. Turn local speaker OFF (if applicable).

Step 7. Disconnect or remove any metering plugs or test set.

Step 8. Insure the cabinet doors are locked.

Step 9. Insure that vents in cabinet are unobstructed.

3. MAINTENANCE TECHNIQUES

3.1 GENERAL

Maintenance procedures for individual chassis which comprise this station are contained in the applicable section of this manual. Module maintenance information is provided in separate manual 68P81060E70. As an aid to isolating a malfunction to a specific chassis or module, a variety of techniques are appropriate.

3.2 TRANSMITTER AND RECEIVER

Most troubles in the transmitter or receiver can be quickly isolated with metering checks. A log of normal meter readings *for this station* should be maintained. Each time maintenance is performed, the meter readings should be entered into the log. Variations from the previous readings can isolate a malfunction or may indicate an impending failure. If no previous meter readings are available, typical or minimum meter readings may be found with the Receiver RF and I-F, Exciter, Power Amplifier or Power Control Board instruction sections, as well as metering procedures.

3.3 POWER SUPPLY

A check of power supply voltages under load and no-load conditions (transmit and standby) should quickly isolate any malfunction.

3.4 REMOTE CONTROL UNIT

Isolation of a malfunction in the control portion of the unified chassis requires a functional understanding of the overall station operation and the inter-relationship between the various modules and chassis of the station. The Functional Description section along with the Remote Control Module Diagrams section of manual 68P81060E70 provide necessary information. With a basic understanding of station operation, troubles may be isolated by analyzing the following questions:

1. Are all interlocks working normally?
2. Can the station be operated locally but not remotely? If so, this eliminates many circuits as possible sources of trouble.
3. How many modes are inoperable? Concentrate testing on circuits that are common to the inoperable modes.
4. Are adjustments properly set? This includes audio level adjustments at the station *and at the remote control point*.
5. Are jumpers properly installed? The many jumpers in this equipment provides vast flexibility, but could be a source of trouble if improperly added, removed, or not removed as the case may be.

4. ROUTINE MAINTENANCE CHECK LIST

Item	Check
Receiver	Measure the signal level required to obtain 20 dB quieting.
	Compare meter readings with the minimum value and all previous readings taken. Realign the receiver, if necessary.
	For PL stations, check for proper operation of the PL decoder. Does the squelch open when the proper PL tone or binary code is detected?
Transmitter	Measure transmitter output power.
	Compare meter readings with the minimum value and all previous readings are taken. Realign the transmitter, if necessary.
	Verify that each transmitter channel is on frequency and adjust if necessary.
	Tune and load the transmitter to the antenna.
	Measure transmitter frequency deviation voice, PL coded and digital modulation. Adjust the IDC control, if necessary.
	Measure the exciter modulator sensitivity.
	Check the PA blower filters. Cleaning is required once every six months.
System Operation	Measure and adjust the audio input to the exciter.
	Measure and adjust the receiver(s) audio output to the control line.
	Check control line levels and functions for proper operation.
	Adjust receiver(s) on frequency with the distant transmitter(s) in the system
	Check for proper repeater operation on repeater models.
	Check all accessory equipment for proper operation.
After Performing Maintenance	Check all items listed in the Concluding Local Operation paragraph of this section of the instruction manual.

5. TABLE OF RECOMMENDED TEST EQUIPMENT

Type of Equipment or Type of Measurement	Equipment Characteristics	Recommended Type
Transmitter Frequency Measurement	Frequency: 928-960 MHz Accuracy: ±.00001% or better	Model R1200 Series Service Monitor.
Transmitter Deviation Measurement	Peak reading type for voice or sinusoidal wave; scales for accurate reading of ±5 kHz deviation (and ±1 kHz deviation for *Private-Line* models)	Model R1200 Series Service Monitor.
Transmitter Power Output Measurement	928-960 MHz; 50 ohms; at least 0-250 watts 50 ohm dummy load; at least 150-200 watts	Motorola Wattmeter with appropriate element. Motorola Model T1013 RF Load Resistor.
RF Signal Generator for Receiver Testing	25 to 960 MHz; FM; high-stability; accurate adjustable output 0 to 1000 microvolts	Motorola Model R1200 Series Service Monitor. FM signal generator — equivalent to following specs: Frequency Range: 800 to 960 MHz Calibration Accuracy: 0.25% Stability: ±50 ppm over 15 min. period after 15 min. warmup
Audio Voltage Measurements RF Millivoltmeter	High impedance (10 megohm); dBm scale. Accurate high frequency (up to 800 MHz) voltage measurements at the millivolt level.	Motorola Model S1053 Solid Solid-State AC Voltmeter. Motorola S1339 Analog or S1340 Digital with a 50 ohm BNC adapter tip.
Audio Signal Generator for audio circuit testing in receiver and transmitter	Variable amplitude 0 to 1 volt; 1000 Hz tone (300 to 3000 Hz preferred); sinusoidal wave.	Motorola Model S1067 Solid-State Audio Oscillator. Motorola Model TEK-1 Tone Oscillator. Motorola Model R1200 Series Service Monitor.
DC Voltage Measurements, Resistance Measurements, RF Voltage Measurements.	High impedance (11 megohm) dc multimeter.	Motorola S1063 Solid-State DC Multimeter with SLN6055A RF Probe below 400 MHz; Motorola S1339 RF Millivoltmeter above 400 MHz. Motorola Model R1001 Digital Multimeter.
Waveform Measurements	Oscilloscope: Audio Circuit Measurement. RF Circuit Measurements, at least 50 MHz bandwidth.	Any general purpose oscilloscope. A high quality instrument is required.
Contact Removal Tool	Used to remove female wire terminals from metering cable connector.	Motorola Part No. 66B84690C01.

6. ALIGNMENT

The following paragraphs contain complete transmitter alignment procedures. For convenience, this information is also contained in the applicable section.

NOTE

Before initiating alignment procedures, insure that the filament voltage is properly adjusted (refer to section 68P81031E53).

6.1 EXCITER ALIGNMENT

6.1.1 Excepts From FCC Regulations

FCC Regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a first or second class commercial radiotelephone operator's license or by personnel working directly under their immediate supervision.

2. The power input to the final radio frequency stage shall not exceed the maximum figure specified on the current station authorization. This power input shall be measured and the results recorded:

   - When the transmitter is initially installed.
   - When any change is made in the transmitter which may increase the power input.
   - At intervals not to exceed one year.

3. Frequency and deviation of a transmitter must be checked:

   - When it is initially installed.
   - When any change is made in the transmitter which may affect the carrier frequency or modulation characteristics.
   - At intervals not to exceed one year.

6.1.2 Local Transmitter Keying

NOTE

Before initiating any local transmissions, monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module XMIT switch or activating the push-to-talk microphone switch. Voice is transmitted using the local microphone.

6.1.3 Frequency Calculations

$$f_o = \frac{f_e}{12} \quad (154.6\text{-}160\ \text{MHz})$$

Where: f_o = oscillator frequency
f_e = exciter output frequency

6.1.4 Transmit Oscillator Frequency Adjustment

6.1.4.1 The transmitter oscillator is either a high stability, ovenized unit employing a warp capacitor for fine frequency adjustment, or a frequency synthesizer. The unit is mounted on the TRN4847A Oscillator Mounting Kit which provides connections to the exciter modulating circuitry.

6.1.4.2 Perform transmit frequency adjustments as follows:

Step 1. Apply power to the station for 15 minutes to allow the oscillator oven to stabilize.

Step 2. Couple a frequency counter with a time base of at least 0.1 ppm to the PA output. Attach test equipment as indicated in Figure 1.

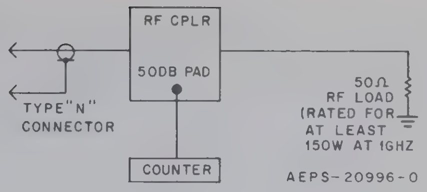


Figure 1. Frequency Adjust Equipment Setup

Step 3. Remove the silver colored plug (labeled FREQ ADJUST) from the end of the oscillator.

Step 4. Using a tuning tool, adjust the screw behind the silver plug until the frequency registered on the counter matches the specified rf carrier frequency.

Step 5. Replace the silver plug and remove all test equipment.

6.1.5 Deviation (IDC) Adjustment

Step 1. It is assumed that the transmit channel has been "warped" on frequency before attempting to adjust the IDC circuit.

Step 2. Connect an audio oscillator to the exciter input (pin 12, accessible from front of station behind exciter cover).

Step 3. Set the audio oscillator for 1000 Hz @1 volt (rms).

Step 4. Key the transmitter and adjust the IDC control for ±5 kHz deviation.

Step 5. Reduce the audio oscillator output to 0.25 volts. Essentially, full deviation should still be indicated. Less than full deviation may indicate weak or inoperative exciter audio stages.

Exciter Alignment Procedure

Step	Adjust	Metering Plug Location	Selector Switch Position	Meter Rev. Switch and Ref A-B Switch (See Note)	Stage and Procedure
1					SET UP — Key the transmitter with the XMTR ON pushbutton on the portable test set.
2	POWER SET				OUTPUT — Turn the POWER SET control fully counterclockwise. Unkey the transmitter.
3	FREQUENCY SWITCH	EXCITER	2	OFF REF A	CHANNEL ELEMENT — Select the desired frequency on multi-frequency stations. Key the transmitter. The test set meter 2 should indicate at least 10 uA.
4	ALL EXCITER COILS	EXCITER	5	OFF REF A	PRE-ALIGNMENT — If the exciter is completely untuned and shows no meter 5 readings, set cores of tuning coils L401 to L406 to the top of their coil forms (away from circuit board). Set cores of L407 and L408 per the exciter pre-tuning chart. If a meter 5 reading is available proceed to Step 7.
5	L401	EXCITER	2	OFF REF A	BUFFER OUTPUT — Tune L401 for minimum meter reading.
6	L401, L402	EXCITER	3	OFF REF A	BUFFER OUTPUT — Tune L402 and then L401 for peak meter reading.
7	L403	EXCITER	3	OFF REF A	TRIPLER OUTPUT — Tune L403 for minimum meter reading.
8	L403, L404	EXCITER	4	OFF REF A	TRIPLER OUTPUT — Tune L404 and then L403 for peak meter reading.
9	L405	EXCITER	4	OFF REF A	FIRST DOUBLER OUTPUT — Tune L405 for minimum meter reading.
10	L405, L406	EXCITER	5	OFF REF A	SECOND DOUBLER OUTPUT — Tune L406, and then L405 for peak meter reading.
11	L407, L408	EXCITER	5	OFF REF A	EXCITER OUTPUT — Tune L407 then L408 for peak meter reading.
12	L407, L408	PA	1	METER REV REF A	EXCITER OUTPUT — Move the metering plug to the PA. Tune L408 and then L407 for peak meter reading.
13					Repeat Steps 6, 8 and 10.
14					Align the power amplifier.

NOTE

Metering may be performed using either optional built-in meter (if so equipped) or by using a Motorola S1056 thru S1059 Series Portable Test Set. All meter readings are based on a 2000 ohm equivalent series resistance in the meter. Therefore, meters not having a 2000 ohm series resistance must have their readings corrected. The following Exciter Alignment Procedure is written to cover all three cases. The OSC. & METER REV. SWITCH column refers to portable test set usage — polarity is automatically reversed as required when built-in metering is used.

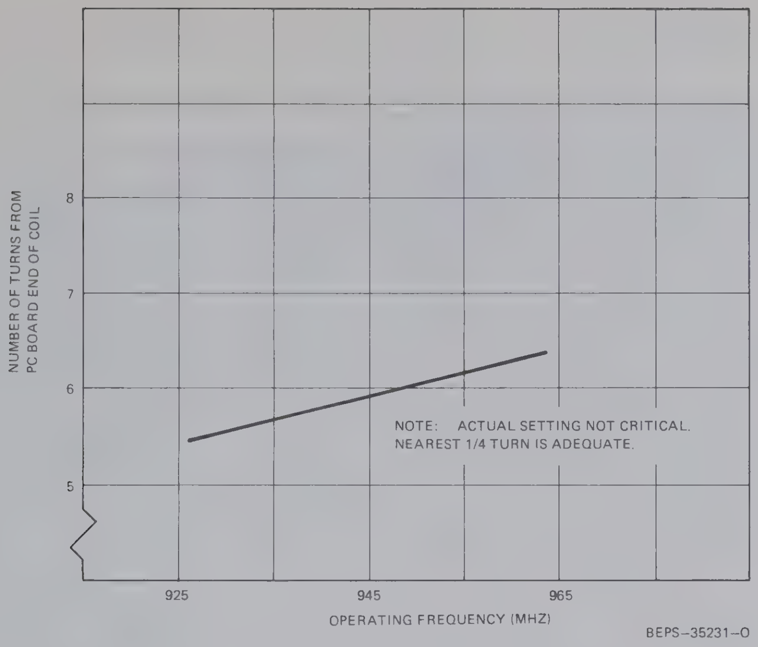


Figure 2. Tuning Preset for Exciter Coils

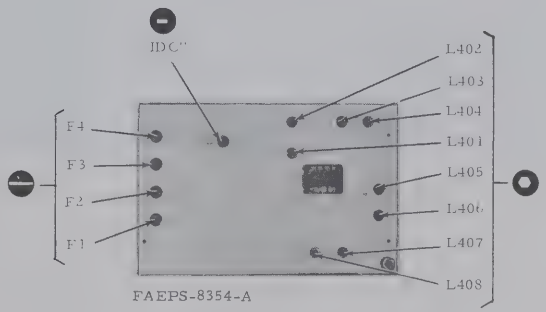

IDCT
L402
L403
L404
L401
L405
L406
L407
L408
F4
F3
F2
F1
FAEPS-8354-A

Figure 3. Exciter Adjustment Locations

6.2 IPA POWER SETTING PROCEDURE

NOTE

If the transmitter is to be brought back up to rated power after turning down the POWER SET control for alignment or troubleshooting procedure, proceed directly to Step 4.

Step	Adjust	Metering Plug Location	Test Set Selector Switch Position	Meter Rev. Switch & Ref. A-B Switch	Stage and Procedure
1	Power Set and Drive	Power Control Board	Wattmeter		Pre-Setting of Controls: Adjust the drive limit control fully counterclockwise (maximum drive). Adjust the Power Set Control fully clockwise (near maximum power output). Connect a wattmeter and load to the directional coupler rf output connector and remove the shelf from over the power control board.
2	Drive Limit	Power Control Board	Wattmeter		Key Transmitter. Adjust drive limit (R609 on power control board) until a power output of 20 watts is obtained. If power output is less than 20 watts, see IPA, and power control board maintenance sections. Unkey the transmitter and replace shield.
3	Power Set	Power Control	Wattmeter		Key the transmitter. Adjust the power set control (R607 on power control board) until power output is within the station licensing parameters. Unkey the transmitter. On multi-frequency radios, check drive limit on both channels. If necessary, readjust Drive Limit control so the lowest power channel is set to 20 watts. If the Drive Limit control cannot obtain a high enough reading, set it fully counter-clockwise (minimum drive limit). Unkey transmitter.
4	Power Set	Power Control Board	Wattmeter		Power Set: Key transmitter. Adjust the power set control ccw and set power output per Table 5 under Power Set. On multi-frequency radios, check power output on all channel. If necessary, readjust Power Set so the lowest power channel is set per Table 5 under Power Set. Unkey transmitter. This completes the IPA power setting procedure.
5	Filament Voltage	P.A.	Voltmeter		Verify standby filament voltage of 6.3 V dc. Key exciter - IPA and verify that filament voltage drops to 4.7 V dc. Readjust as necessary with controls located on the power supply regulator board.

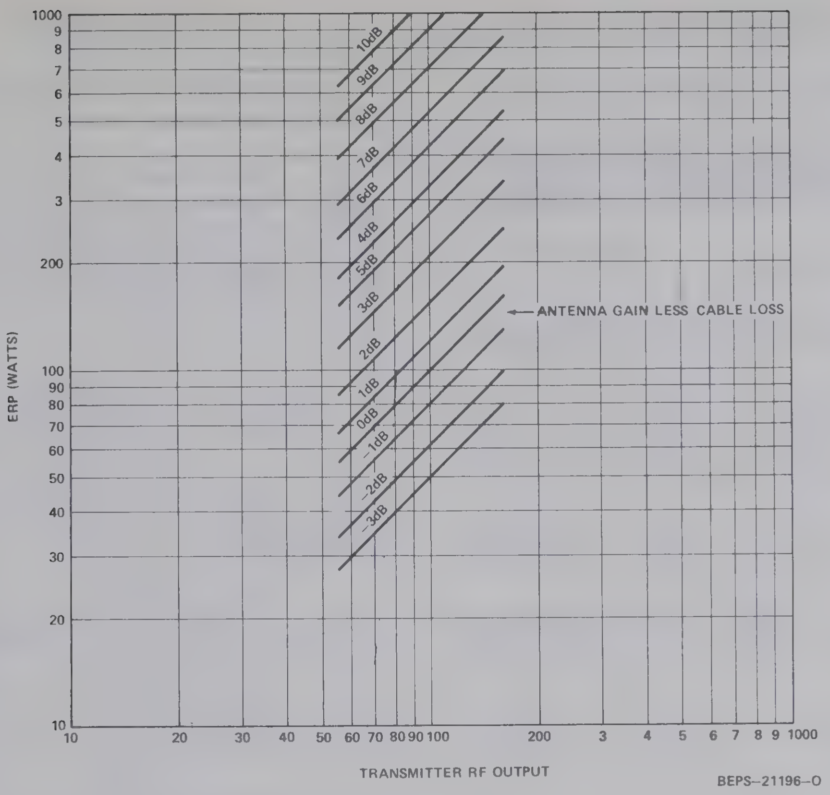
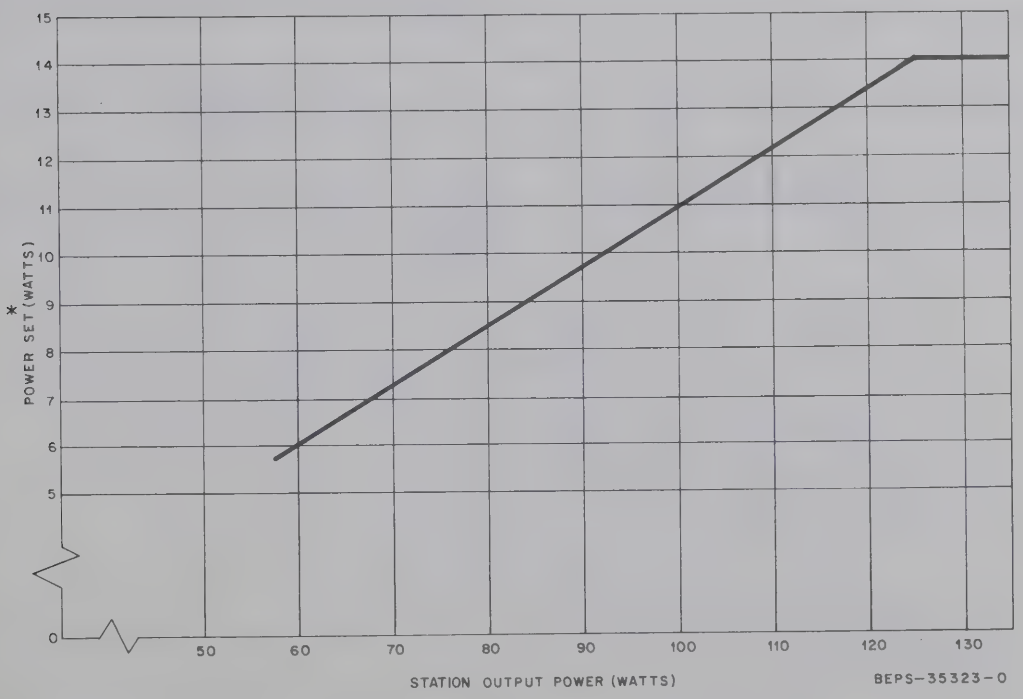


Figure 4. Effective Radiated Power



* NOTE: POWER SET IS MEASURED AT P801 (OUTPUT CABLE OF DIRECTIONAL COUPLER)

Figure 5. IPA Power Output

6.3 FINAL PA ALIGNMENT PROCEDURE

CAUTION

High voltages are present when power is applied to the station.

6.3.1 Preliminary Adjustment

Step 1. Insure that no ac power is applied to the station.

Step 2. Before attempting to align the power amplifier, insure that the exciter, IPA, and low voltage power supply adjustments have been made.

Step 3. Connect a 250 watt wattmeter between the antenna output connector and the antenna.

Step 4. Loosen locking screws on the output coupling, output fine tuning, input coupling, and input line tuning controls.

Step 5. Set the controls on amplifier as indicated below. (See Figure 1.)

- OUTPUT TUNING CONTROL — Fully ccw (as looking down on the cavity) or control knob fully extended out.
- PLATE CURRENT CONTROL — Fully ccw.
- OUTPUT COUPLING CONTROL — Fully ccw (as looking down on cavity) or control knob fully in.

Step 6. Tighten down *all* screws on power amplifier cavity, front and rear. This step is important to insure proper operation of the cavity.

6.3.2 TUNING PROCEDURE

After making preliminary adjustments, perform the following tuning procedure.

Step 1. Apply power to the station. After the transmitter is enabled by the transmit inhibit circuitry (see section 68P81031E53 in the Power Supply section), key the station. Slide the coarse input coupling control in and out. Observe the best dip on power control meter 2 reading.

NOTE

The dip can be very sharp, so move the control very slowly in small amounts.

Step 2. Alternately turn the input coupling and input tuning controls for minimum reflected power (power control meter 2).

Step 3. Alternately turn the output coupling and output tuning controls for maximum power output.

Step 4. Increase the plate current adjustment control to achieve approximately 300 mA or 125 W output, whichever comes first.

Step 5. Adjust the input tuning and input coupling controls to minimum power control meter 2 reading.

Step 6. Adjust output tuning and output coupling controls for maximum power output. Continue adjustments until no further improvement can be obtained.

Step 7. Adjust the plate current control to achieve 125 W output from the station.

Step 8. Tighten down the output coupling and tuning controls and then the input coupling shaft and tuning control.

OSCILLATOR MOUNTING KIT

MODEL TRN4847A, F1

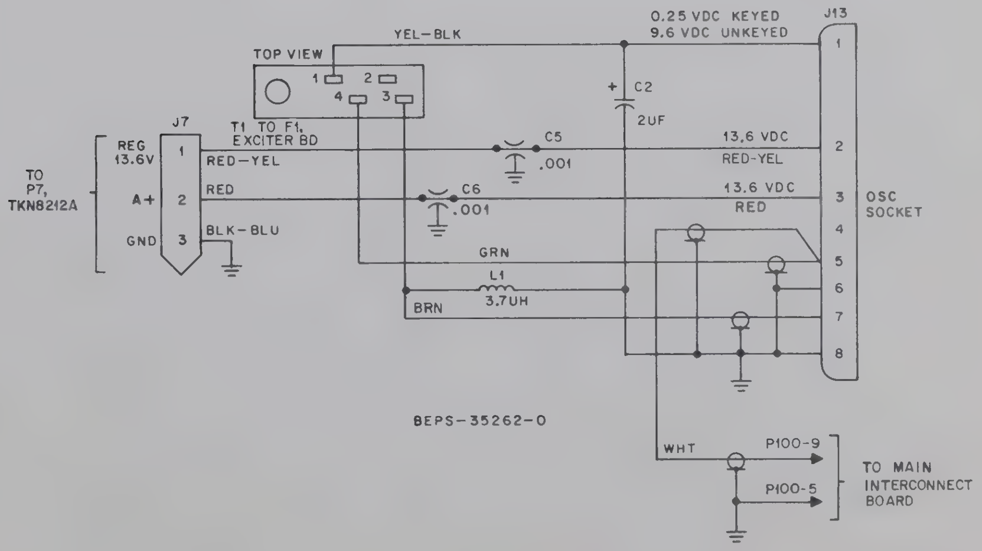
parts list

TRN4847A Oscillator Mounting Kit PL-8166-O

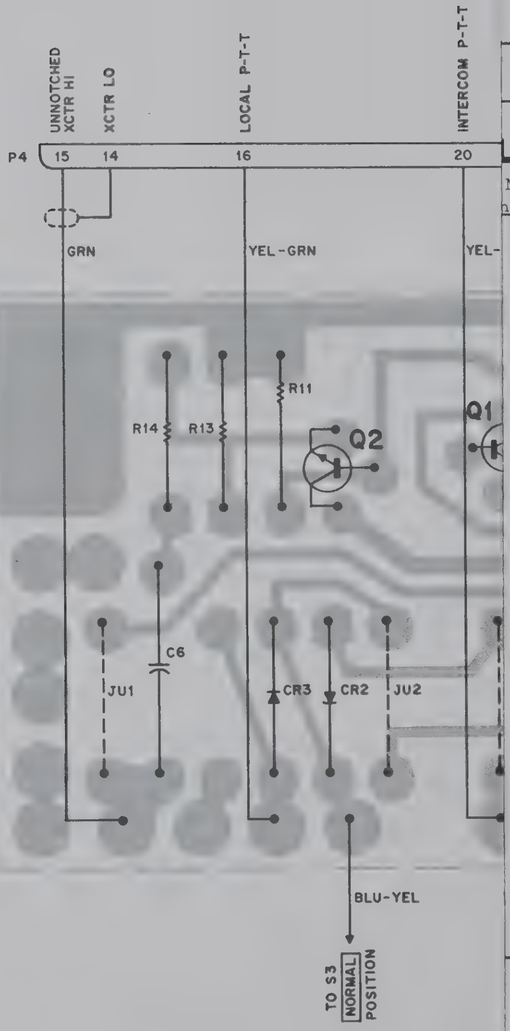
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C2	23-82601A34	2 uF + 150-10%; 25 V
C3, 4		NOT USED
C5, 6	21-861219	.001 uF + 100-0%
		coil, rf:
L1	24-82835G21	3.7 uH
		connector, receptacles:
J7	15-10183B12	housing; 3 contact
		connector, plug:
P13	9-6740	socket, 8 contact
		mechanical parts
	1-80761D64	ASSEMBLY, oscillator; includes: ref. items C5, 6 and;
	4-83755H01	WASHER, shoulder; 2 used
	7-82393N01	BRACKET, oscillator
	42-82393N01	CLIP
	1-80791B45	ASSEMBLY, oscillator cable; includes: ref. items J7, P13, and;
	9-83208C02	SOCKET, channel element
	26-83193C06	SHIELD, channel element
	30-824274	WIRE, shield; GRN; 8" used
	30-859004	CABLE, coaxial; RG188/U; 9" used
	37-109120	GROMMET, rubber
	42-10217A02	STRAP, tie
	2-114043	NUT, 4-40 x 3/16 x 1/16"; 2 used
	3-2950	SCREW, machine; 4-40 x 1/4"; 2 used
	3-136891	SCREW, tapping; 4-24 x 1/4"; 4 used
	15-82427N01	COVER, oscillator
	29-84706E05	TERMINAL, crimp; 3 used
	30-83794C01	COAX CABLE, 12 inches
	39-10184A24	RECEPTACLE CONNECTOR; 2 used
	42-82143C09	CLIP

FUNCTION

The oscillator mounting kits are assemblies used to facilitate external mounting of a highly stable oscillator.


0.25 VDC KEYED
9.6 VDC UNKEYED
J13
YEL-BLK
TOP VIEW
1
2
4
3
C2
2UF
J7
T1 TO F1, EXCITER BD
REG 13.6V
A+
GND
TO P7, TKN8212A
RED-YEL
RED
BLK-BLU
C5
.001
C6
.001
13.6 VDC
RED-YEL
13.6 VDC
RED
OSC SOCKET
GRN
L1
3.7UH
BRN
1
2
3
4
5
6
7
8
BEPS-35262-O
WHT
P100-9
P100-5
TO MAIN INTERCONNECT BOARD

METERING & INTERCOM


UNNOTCHED XCTR HI
XCTR LO
LOCAL P-T-T
INTERCOM P-T-T
P4
15
14
16
20
GRN
YEL-GRN
YEL-
R14
R13
R11
Q2
Q1
C6
JU1
CR3
CR2
JU2
BLU-YEL
TO S3 NORMAL POSITION

LIST

Meter Chassis & Intercom Kit
ntercom Board PL-2156-C

MOTOROLA PART NO.	DESCRIPTION
	CAPACITOR, fixed: uF;
8-82905G11	0.22 ±10%; 50 V
23-865137	4.7 ±20%; 25 V
8-82905G11	0.22 ±10%; 50 V
23-865137	4.7 ±20%; 25 V
	SEMICONDUCTOR DEVICE, diode:
48-83654H01	silicon
	SWITCH, magnetic reed: 13.4 V dc
80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
	TRANSISTOR:
48-869642	NPN; type M9642
	RESISTOR, fixed: +10%; 1/4 W;
6-124C69	6.8k
6-124C51	1.2k
6-124C53	1.5k
6-124C43	560
6-124C49	1k
6-124C69	6.8k
6-124C83	27k
6-124C93	68k
6-124C43	560
6-124C19	56
6-124C85	33k
6-124C75	12k
6-124C49	1k
6-124C45	680

“COMPA-STATION”
METERING & INTERCOM
MODEL TLN1740A
INTERCOM
MODEL TLN1745A

FUNCTION

--Model TLN1740A provides built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.

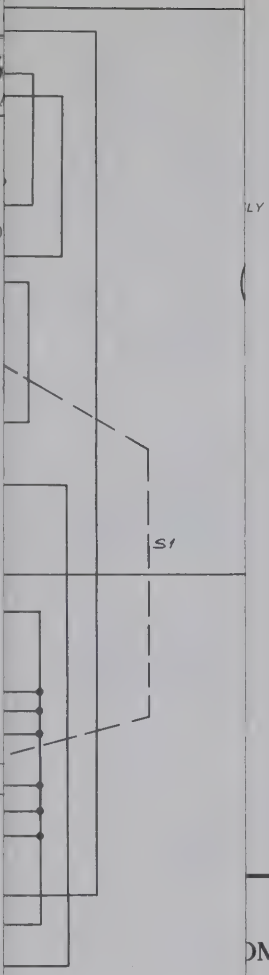
REFEREN
SYMBO

PARTS
TLN5657

C100
CR100, 10
J1
LS1
M100
P100
P101
P102
R100
R101
R102
S1
S2, 3

SIS)
KIT
ASSIS)
KIT

NOTE:
For o
order



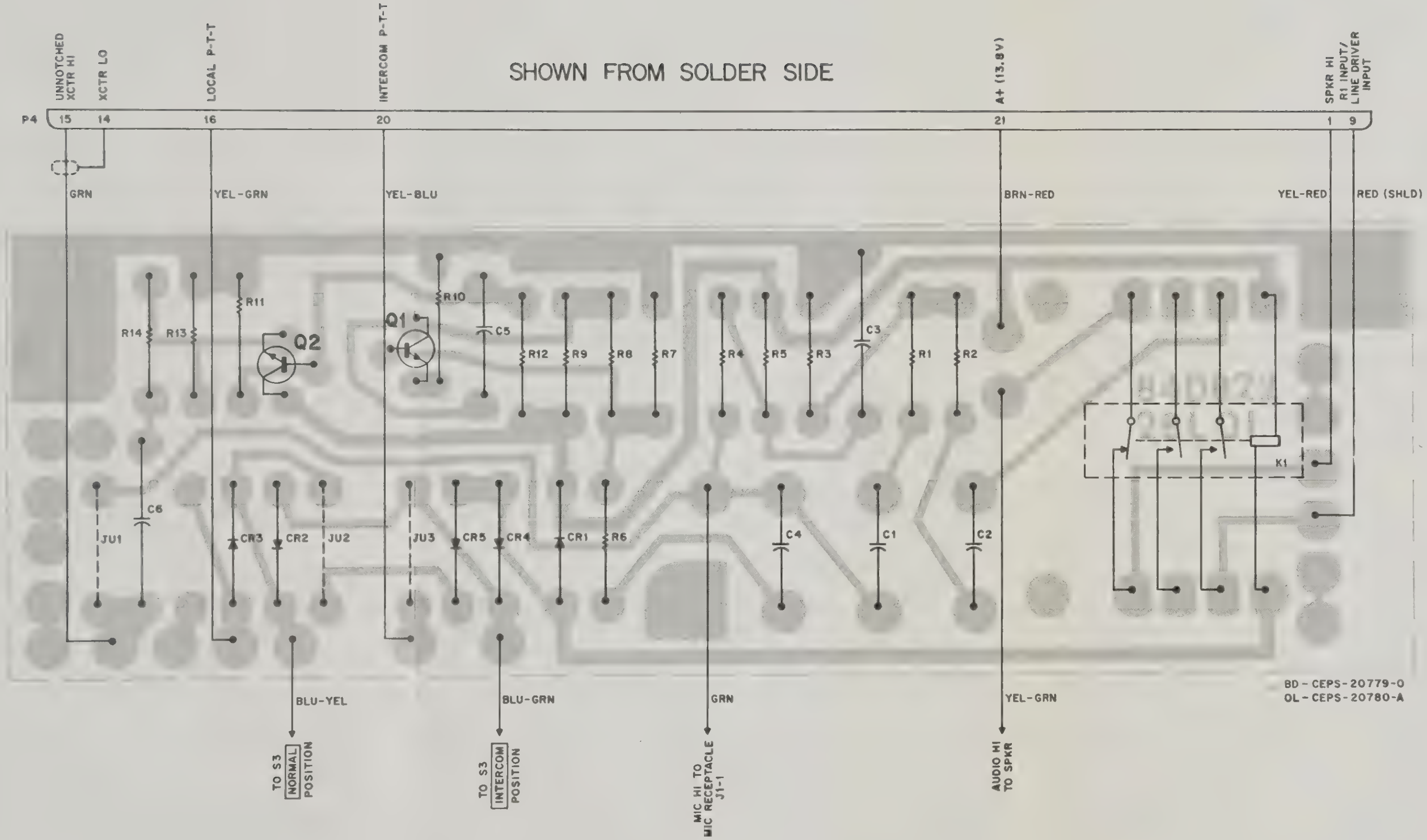
DM switch in

N-THE-AIR”
LK switch is
yed. Speak in-
. Release the
ver audio will

vitch to OFF

, place the
ER position.
e remote con-

METERING & INTERCOM


SHOWN FROM SOLDER SIDE
UNNOTCHED XCTR HI
XCTR LO
LOCAL P-T-T
INTERCOM P-T-T
A+ (13.8V)
SPKR HI
R1 INPUT/ LINE DRIVER INPUT
P4
15
14
16
20
21
1
9
GRN
YEL-GRN
YEL-BLU
BRN-RED
YEL-RED
RED (SHLD)
R14
R13
R11
Q2
Q1
R10
C5
R12
R9
R8
R7
R4
R5
R3
C3
R1
R2
K1
C6
JU1
CR3
CR2
JU2
JU3
CR5
CR4
CR1
R6
C4
C1
C2
BLU-YEL
BLU-GRN
GRN
YEL-GRN
BD-CEPS-20779-0
OL-CEPS-20780-A
TO S3 NORMAL POSITION
TO S3 INTERCOM POSITION
MIC HI TO MIC RECEPTACLE J1-1
AUDIO HI TO SPKR

PARTS LIST

TLN1552A Meter Chassis & Intercom Kit
TLN5167A Intercom Board PL-2156-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF;
C1,2	8-82905G11	0.22 ±10%; 50 V
C3	23-865137	4.7 ±20%; 25 V
C4,5	8-82905G11	0.22 ±10%; 50 V
C6	23-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1 thru 5	48-83654H01	silicon
		SWITCH, magnetic reed: 13.4 V dc
K1	80-84157B02	dual-coil; 2 form "A". 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1,2	48-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W.
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN5657A Meter Kit PL-3415-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
[illegible]	[illegible]	CAPACITOR, fixed: .01 uF +80-20%; 500 V
CR100, 101	48-82420C03	DIODE: (SEE NOTE) silicon
J1	9-830418	CONNECTOR, receptacle: 4-contact
LS1	50-84710G01	LOUDSPEAKER; permanent: dynamic type; 3"; square 16 ohms voice coil impedance
[illegible]	[illegible]	[illegible] R, dc: [illegible]: 0-50 microamperes
[illegible] [illegible] [illegible]	[illegible] [illegible] [illegible]	CONNECTOR, plug: test probe; BLACK test probe; RED 7-contacts
[illegible]	[illegible]	[illegible]
R101 R102	6-13756D88 6-124A33	100k ±1%; 1/2 W 220 ohm ±5%; 1/4 W
[illegible] [illegible]	[illegible] [illegible]	[illegible] rotary; 2 section slide; dpdt
REFERENCED ITEMS		
	-483208	GROMMET
	[illegible]	GRILLE, speaker
	[illegible]	KNOB, control
	[illegible]	STRAP, cable; 4 req'd.
	[illegible]	CLAMP, cable
	[illegible]	COVER, 2 req'd. (used with P102)
	[illegible]	CABLE, 7-conductor; 42" long (used with P102)
	[illegible]	CLIP: 2 req'd. (used with P102)
	[illegible]	CHASSIS, meter
	[illegible]	TERMINAL STRIP, 1-lug
	[illegible]	CLIP, probe; 3 req'd.
	[illegible]	COVER, meter
	[illegible]	RETAINER, nylon; 2 req'd.
	[illegible]	BUMPER, rubber; 4 req'd.

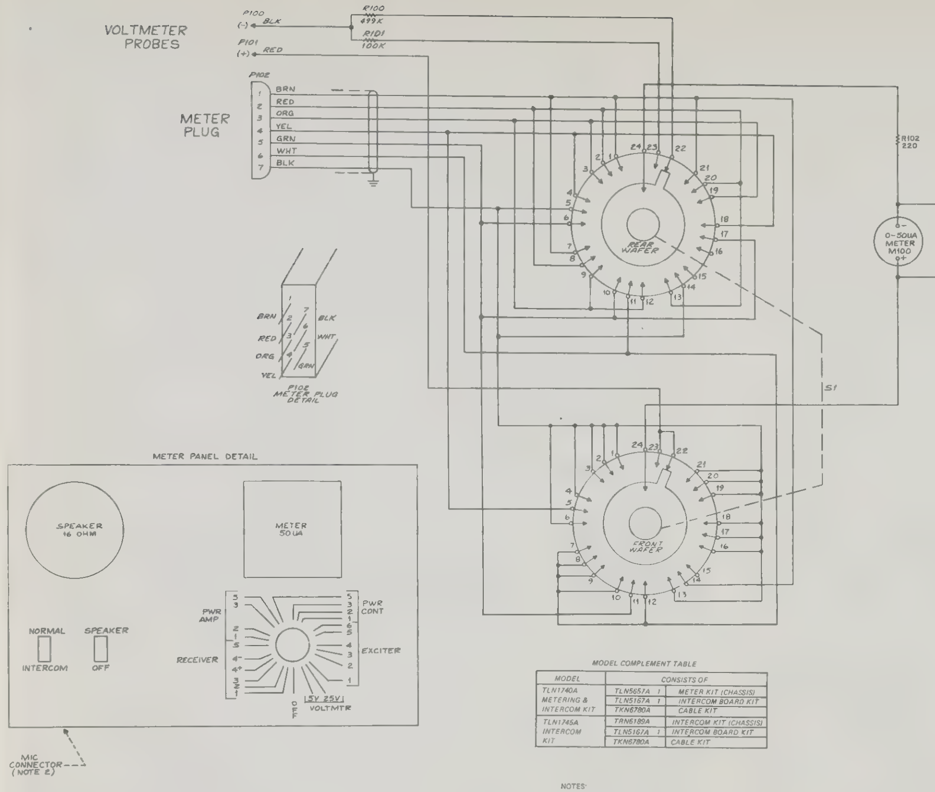
[illegible] performance, replacement diodes must be [illegible] otorola part number.

TRN6189A Intercom Chassis Kit PL-3452-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1	9-830418	CONNECTOR, receptacle: 4-contact
LS1	50-84710G01	SPEAKER 3 ; 16 ohm
R103 R104	17-82177B55 17-82177B44	RESISTOR, fixed; ±10%: 8; 7 W 13; 15 W
[illegible]	40-11589	SWITCH, slide: spst
NON-REFERENCED ITEMS		
	1-80775B59	CHASSIS (riveted) incl. ref. item S2 and S3
	1-80775B51	COVER ASSEMBLY
	2-132616	LOCKNUT, speaker (No. 6-32) 4 req'd.
	2-83896G01	NUT, hex (used with J1)
	4-7699	LOCKWASHER (used with J1)
	5-483208	GROMMET, rubber
	35-84530G01	GRILLE, speaker
	42-82143C02	CLAMP, cable (1/4")
	42-10217A02	TY-WRAP, cable: 4 req'd.
	3-134169	SCREW, machine: No. 4-40 x 1/4"; 7 req'd.
	3-129498	SCREW, machine: No. 6-32 x 5/16"; 4 req'd.
	29-115147	LUG, solder (No. 5)
	31-823389	TERMINAL, strip; 2 used

TKN6780A Cable Kit PL-3418-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P4	[illegible] 9-84151B03 14-84556B02	CONNECTOR: includes: CONTACT, receptacle; 10 req'd HOUSING
NON-REFERENCED ITEM		
	42-10217A02	STRAP, cable harness; 7 used


VOLTMETER PROBES
P100 (-) BLK
P101 (+) RED
R100 499K
R101 100K
METER PLUG
P102
BRN
RED
ORG
YEL
GRN
WHT
BLK
REAR WAFER
FRONT WAFER
P102 METER PLUG DETAIL
M100 0-50uA METER
CR100
CR101
C100 .01UF
R102 220
S1
METER PANEL DETAIL
SPEAKER 16 OHM
METER 50uA
NORMAL
INTERCOM
SPEAKER
OFF
PWR AMP
RECEIVER
PWR CONT
EXCITER
OFF
(25V) (5V) VOLTMTR
MIC CONNECTOR (NOTE 2)

MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF	
TLN1740A METERING & INTERCOM KIT	TLN5657A 1	METER KIT (CHASSIS)
	TLN5167A 1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1745A INTERCOM KIT	TRN6189A	INTERCOM KIT (CHASSIS)
	TLN5167A 1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT

NOTES:

1. THIS OPTION REQUIRES THE USE OF A MOTOROLA MODEL TMN6071A MICROPHONE, OR EQUIVALENT
2. WITH 12 W STATIONS, FINAL PA CURRENT IS METERED AT PWR CONT MTR 5 WITH ALL OTHER STATIONS, FINAL PA CURRENT IS METERED AT PA MTR 3.

JUMPER TABLE

JUMPER	NORMAL	WHEN "SPECTRA TAC" IS ADDED (CUT CR2)
JU1	OUT	OUT
JU2	OUT	IN
JU3	OUT	IN

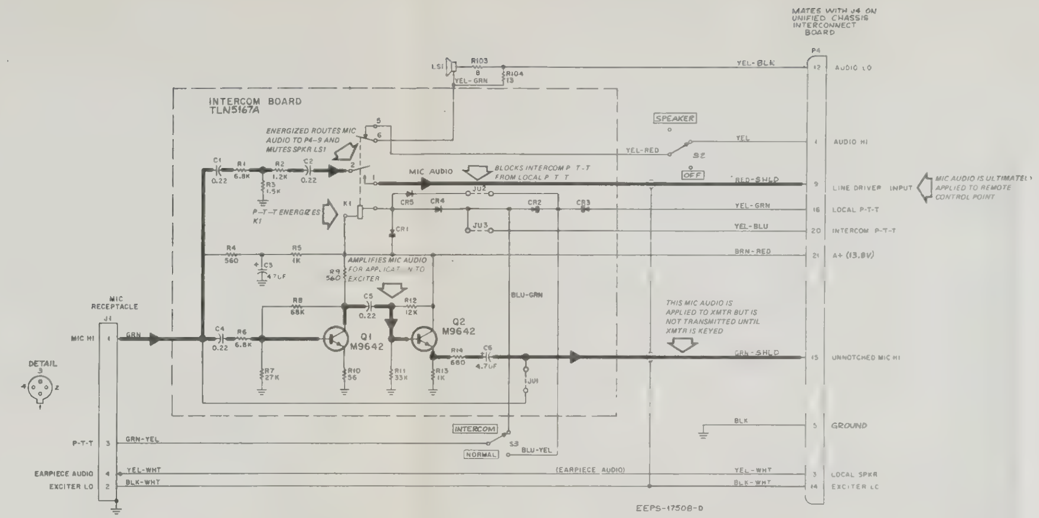
LEGEND:

⇨ THEORY NOTE

→ PRIMARY SIGNAL FLOW

METER SELECT TABLE

P102 METERING PLUG CONNECTED TO	METER SELECTOR SW			FUNCTION METERED
	MTR NO		POSITION	
RCVR RF & I-F BOARD	RECEIVER	1	1	CHANNEL ELEMENT OUTPUT (3RD HARMONIC)
		2	2	1ST DOUBLER OUTPUT
		3	3	2ND DOUBLER OUTPUT
		4 (+)	4	DISCRIMINATOR OUTPUT
		4)	5	DISCRIMINATOR OUTPUT
		5	6	LIMITER OUTPUT
POWER AMPLIFIER	POWER AMP (NOTE 2)	1	7	PRE DRIVER CURRENT
		2	8	25 W DRIVER CURRENT (75 W MODELS ONLY)
		3	9	FINAL AMPLIFIER CURRENT (EXCEPT 12 W STATIONS)
		5	10	CONTROLLED (ADL) STAGE VOLTAGE
POWER CONTROL BOARD	PWR CONT (NOTE 2)	5	11	FINAL AMPLIFIER CURRENT (12 W STATIONS ONLY)
		3	12	ADL VOLTAGE
		2	13	REFLECTED POWER
		1	14	FORWARD POWER
--	--	–	15	UNUSED
EXCITER	EXCITER	6	16	UNUSED
		5	17	EXCITER OUTPUT
		4	18	DOUBLER INPUT
		3	19	TRIPLER INPUT
		2	20	CHANNEL ELEMENT OUTPUT
		1	21	"IDC" AUDIO OUTPUT
--	--	–	22	25 VOLTS FULL SCALE (NOTE METER IS LABELED 0–50)
--	--	–	23	5 VOLTS FULL SCALE
--	--	–	24	OFF


MATES WITH J4 ON UNIFIED CHASSIS INTERCONNECT BOARD
P4
LS1
R103 8
R104 13
YEL-GRN
YEL-BLK
INTERCOM BOARD TLN5167A
ENERGIZED ROUTES MIC AUDIO TO P4-9 AND MUTES SPKR LS1
C1 0.22
R1 6.8K
R2 1.2K
C2 0.22
R3 1.5K
MIC AUDIO
BLOCKS INTERCOM P-T-T FROM LOCAL P-T-T
P-T-T ENERGIZES K1
K1
CR5
CR4
CR2
CR3
CR1
JU2
JU3
R4 560
R5 1K
C3 4.7UF
R9 560
AMPLIFIES MIC AUDIO FOR APPLICATION TO EXCITER
R8 68K
C5 0.22
R12 12K
Q1 M9642
Q2 M9642
C4 0.22
R6 6.8K
R7 27K
R10 56
R11 33K
R13 1K
R14 680
C6 4.7UF
JU1
BLU-GRN
MIC RECEPTACLE
J1
MIC HI
GRN
DETAIL
P-T-T
GRN-YEL
EARPIECE AUDIO
YEL-WHT
EXCITER LO
BLK-WHT
INTERCOM
S3
NORMAL
BLU-YEL
(EARPIECE AUDIO)
SPEAKER
S2
OFF
YEL
YEL-RED
RED-SHLD
YEL-GRN
YEL-BLU
BRN-RED
GRN-SHLD
BLK
THIS MIC AUDIO IS APPLIED TO XMTR BUT IS NOT TRANSMITTED UNTIL XMTR IS KEYED
MIC AUDIO IS ULTIMATELY APPLIED TO REMOTE CONTROL POINT
12 AUDIO LO
4 AUDIO HI
9 LINE DRIVER INPUT
16 LOCAL P-T-T
20 INTERCOM P-T-T
21 A+ (13.8V)
15 UNNOTCHED MIC HI
5 GROUND
3 LOCAL SPKR
14 EXCITER LO
EEPS-17508-D

OPERATING INSTRUCTIONS

1. METERING

Step 1. Select the function to be metered with the METER switch.

Step 2. Select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board or the power amplifier.

NOTE

> Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used.

Step 3. For receiver discriminator adjustment, use both 4(+) and 4(—) and adjust for meter zero.

Step 4. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 5. To measure miscellaneous station voltages, use the voltmeter probes (P100 and P101) on either the 5 V or 25 V positions. Divide the 5 V full scale reading by 10 to obtain actual voltage and divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER-OFF switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the NORMAL position.

Step 4. The unit is now ready for "ON-THE-AIR" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER-OFF switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER-OFF switch in the SPEAKER position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

"COMPA-STATION" METERING & INTERCOM

MODEL TLN1740A

INTERCOM

MODEL TLN1745A

[redacted]

FUNCTION

--Model TLN1740A provides built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.

Motorola No. PEPS-17760-E
(Sheet 2 of 3)
9/1/80 UP

PARTS LIST

TLN5656A Metering Kit PL-3416-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W unless otherwise stated
R1		NOT USED
R2	17-82177B04	5; 5 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
NON-REFERENCED ITEMS		
	42-890499	CLAMP, cable; 1/2"
	36-82630H01	KNOB, control
	31-490181	TERMINAL STRIP, 1-lug; 2 req'd.
	42-871184	CLIP, probe; 3 req'd.
	30-83678K01	CABLE, 7-conductor; 57" long (used with P102)
	15-83947K01	COVER; 2 req'd. (used with P102)
	42-83948K01	CLAMP, cable; 2 req'd.
	31-835961	TERMINAL BOARD, 18-lug
	27-83400K01	CHASSIS

NOTE:

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

TKN6782A Cable Kit PL-3417-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR:
P4		includes
	9-84151B03	CONTACT, receptacle; 12 req'd.
	14-84556B02	HOUSING

TLN5134A Meter Panel PL-2233-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LIGHT, indicator:
DS1	65-83183G02	includes lamp and GRN lens
DS2	65-83183G04	includes lamp and RED lens
		LOUDSPEAKER, permanent magnet:
LS1	50-83562A01	dynamic type; 4"; square; 4 ohms voice coil impedance
		METER, electrical: 50 uA movements:
M1	72-84864B10	scale: 0-25 volts/amps
M2	72-84864B09	scale: 0-50 microamperes
NON-REFERENCED ITEMS		
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining; 2 used
	2-7009	NUT, hex: 10-32 x 3/8 x 1/8"; 4 used
	3-119916	SCREW, machine: 10-32 x 7/16" 4 used
	3-131964	SCREW, tapping: 6-32 x 3/8; 12 used
	4-7658	WASHER, lock: #10 (split); 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

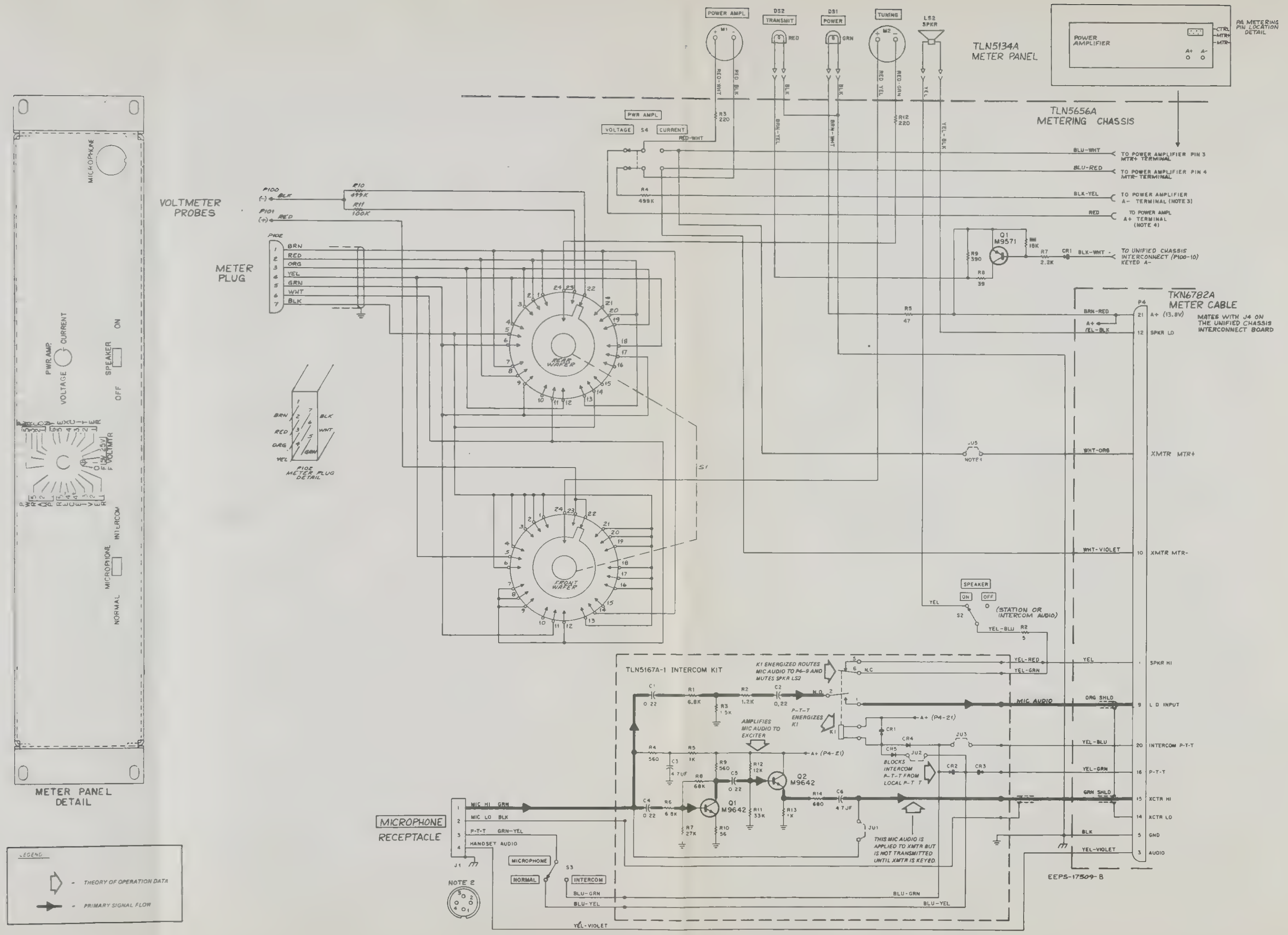
UPRIGHT STATION METERING & INTERCOM

MODELS TLN1739A AND TLN5134A

[redacted]

FUNCTION

Provides built-in metering of over 20 major test points in the transmitter and receiver(s). Plus intercom between the station and the remote control point.


METER PANEL DETAIL
MICROPHONE
PWR AMP
VOLTAGE
CURRENT
SPEAKER
ON
OFF
MICROPHONE
NORMAL
INTERCOM
POWER AMPL
TRANSMIT
POWER
TUNING
SPKR
TLN5134A METER PANEL
POWER AMPLIFIER
TLN5656A METERING CHASSIS
VOLTMETER PROBES
METER PLUG
P102 METER PLUG DETAIL
TO POWER AMPLIFIER
TO UNIFIED CHASSIS INTERCONNECT
TKN6782A METER CABLE
METER WITH J4 ON THE UNIFIED CHASSIS INTERCONNECT BOARD
METER SELECT
XMTR MTR
SPEAKER
(STATION OR INTERCOM AUDIO)
TLN5167A-1 INTERCOM KIT
K1 ENERGIZED ROUTES MIC AUDIO TO P4-8 AND MUTES SPKR LS2
AMPLIFIES MIC AUDIO TO EXCITER
BLOCKS INTERCOM P-T-T FROM LOCAL P-T-T
THE MIC AUDIO IS APPLIED TO XMTR BUT IS NOT TRANSMITTED UNTIL XMTR IS KEYED
SPKR HI
L.O. INPUT
INTERCOM P-T-T
P-T-T
XCTR LO
XCTR HI
GND
AUDIO
MICROPHONE RECEPTACLE
NOTE 2
EEPS-17509-B
LEGEND
THEORY OF OPERATION DATA
PRIMARY SIGNAL FLOW

Motorola No. PEPS-17760-E
(Sheet 3 of 3)
9/1/80-UP

OPERATING INSTRUCTIONS

1. METERING

Step 1. Tuning Meter Usage -- Select the function to be metered with the meter switch. Next, select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board, or the power amplifier. NOTE: Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used. For receiver discriminator adjustment, use both 4(+) and 4(—) and adjust for meter zero.

Step 2. PWR AMP Meter Usage -- Select PA current/voltage monitoring by placing the VOLTAGE/CURRENT switch in the applicable position.

Step 3. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 4. Voltmeter Usage -- Use either the 5 V or 25 V scales as applicable. Divide the 5 V full scale reading by 10 to obtain actual voltage. Divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM. in the NORMAL position.

Step 4. The unit is now ready for "on-the-air" testing. If the micrphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER switch in the ON position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF
TLN1739A METERING CHASSIS	TLN5656A METERING CHASSIS TLN5167A INTERCOM BOARD KIT TKN6782A CABLE KIT
TLN5134A METER PANEL	

NOTES

1. JU5 IN FOR 12 W MODELS. OUT FOR ALL OTHER MODELS
2. INTERCOM REQUIRES THE USE OF A MOTOROLA MODEL TMN6071A MICROPHONE OR EQUIVALENT
3. ON 12-WATT STATIONS, BLK-YEL A(-) LEAD IS CONNECTED TO TB2-2 (-) ON UNIFIED CHASSIS INTERCONNECT BOARD
4. ON 12-WATT STATIONS RED A(+) LEAD IS CONNECTED TO TB2-1 (+) ON UNIFIED CHASSIS INTERCONNECT BOARD

METER SELECT TABLE

P102 METERING PLUG CONNECTED TO	METER SELECTOR SW MTR NO		METER SELECTOR SW POSITION	FUNCTION METERED	
RCVR RF & IF BOARD	RECEIVER	1	1	CHANNEL ELEMENT OUTPUT 3RD HARMONIC	
		2	2	1ST DOUBLER OUTPUT	
		3	3	2ND DOUBLER OUTPUT	
		4 (+	4	DISCRIMINATOR OUTPUT	
		4 (-	5	DISCRIMINATOR OUTPUT	
		5	6	LIMITER OUTPUT	
POWER AMPLIFIER	PA	1	7	PREDRIVER CURRENT	
		2	8	25 W DRIVER CURRENT (75 W MODEL ONLY)	
		5	9	CONTROLLED (ADL) STAGE VOLTAGE	
			10		
POWER CONTROL BOARD	PWR CONT	5	11	FINAL AMPLIFIER CURRENT [illegible] W STATIONS)	
		3	12	ADL VOLTAGE	
		2	13	REFLECTED POWER	
		1	14	FORWARD POWER	
			15	UNUSED	
EXCITER	XCTR	6	16	UNUSED	
		5	17	EXCITER OUTPUT	
		4	18	DOUBLER INPUT	
		3	19	TRIPLER INPUT	
		2	20	CHANNEL ELEMENT OUTPUT	
		1	21	"IDC" AUDIO OUTPUT	
			22	25 VOLTS FULL SCALE	METER IS LABELED 0-50
			23	5 VOLTS FULL SCALE	
			24	OFF	

PARTS LIST

TLN5656A Metering Kit PL-3416-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP: type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe: BLACK
P101	29-82676C02	test probe: RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W unless otherwise stated
R1		NOT USED
R2	17-82177B04	5: 5 W
R3	6-124A33	220
R4, 10	6-84640C61	[illegible]
R5	6-125C17	[illegible]
R6	6-124A77	15k ±5%: 1/4 W
R7	6-124A57	2.2k ±5%: 1/4 W
R8	[illegible]	[illegible]
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH
S1	40-83158C01	rotary: 2 section
2, 3	40-83890A01	slide: dpdt
S4	40-811751	toggle: dpdt
NON-REFERENCED ITEMS		
	[illegible]	CLAMP, cable: 1/2
	[illegible]	KNOB, control
	[illegible]	TERMINAL STRIP, 1-lug 2 req'd.
	[illegible]	CLIP, probe: 3 req'd
	[illegible]	CABLE, 7-conductor: 57" long (used with P102)
	[illegible]	COVER: 2 req'd. (used with P102)
	[illegible]	CLAMP, cable: 2 req'd.
	[illegible]	TERMINAL BOARD, 18-lug
	[illegible]	CHASSIS

NOTE

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
[illegible]		CONNECTOR includes
	[illegible]	CONTACT, receptacle: [illegible]
	[illegible]	HOUSING

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
[illegible]	[illegible]	[illegible]

METERING & INTERCOM

PARTS LIST

TLN5167A Intercom Board PL-5076-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF:
C1, 2	8-82905G11	0.22 ±10%; 50 V
C3	23-865137	4.7 ±20%; 25 V
C4, 5	8-82905G11	0.22 ±10%; 50 V
C6	23-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1 thru 5	48-83654H01	silicon
		SWITCH, magnetic reed: 13.4 V DC:
K1	80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1, 2	48-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W:
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

REFERENC
SYMBOI

PARTS

TLN5900
TLN5993

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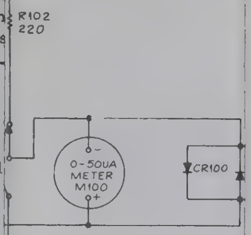

C100	
CR100, 1	
J1	
LS1	
M100	
P100 P101 P102	
R100 R101 R102 R103 R104	
S1 S2, 3	

of readings as a
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01) on either the 5
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the 25 V full scale

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RCOM switch in

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microphone and

"COMPA-STATION" METERING & INTERCOM

MODELS TLN1857A AND TLN1886A

INTERCOM

MODEL TLN1745A

FUNCTION

--Models TLN1857A and TLN1886A provide built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.

METER SELECT TABLE

LOW BAND–MID BAND TLN1886A/TLN1887A		HIGH BAND TLN1857/TLN1859A		820 MHz/UHF TLN1857A/TLN1859A	
POL	FUNCTION METERED	POL.	FUNCTION METERED	POL.	FUNCTION METERED
REV	EXTENDER CHANNEL ELEMENT	REV	–	FWD	CHANNEL ELEMENT OUTPUT
REV	–	REV	–	FWD	FIRST DOUBLER OUTPUT
REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
FWD	P.A. INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
FWD		REV	CONTROLLED AMP OUTPUT	FWD	25 W DRIVER CURRENT (75 W)
FWD		REV	INPUT FINAL AMP 90/100 W/60 W PREDRIVER	FWD	FINAL AMP CURRENT (EXCEPT 12 W MODELS)
FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP.	FWD	–
FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED (ADL) STAGE VOLTAGE FINAL AMPLIFIER CURRENT (12 W ONLY)
FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADL VOLTAGE (ALL OTHERS)
FWD	–		–	FWD	ADL VOLTAGE NOT USED (800 MHz ONLY)
FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
	UNUSED		UNUSED		UNUSED
FWD	SECOND AMPLIFIER – (LB) DRIVER INPUT – (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
FWD	FIRST AMPLIFIER (LB) DOUBLER INPUT – (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50
	OFF		OFF		OFF

EPS–23014–A

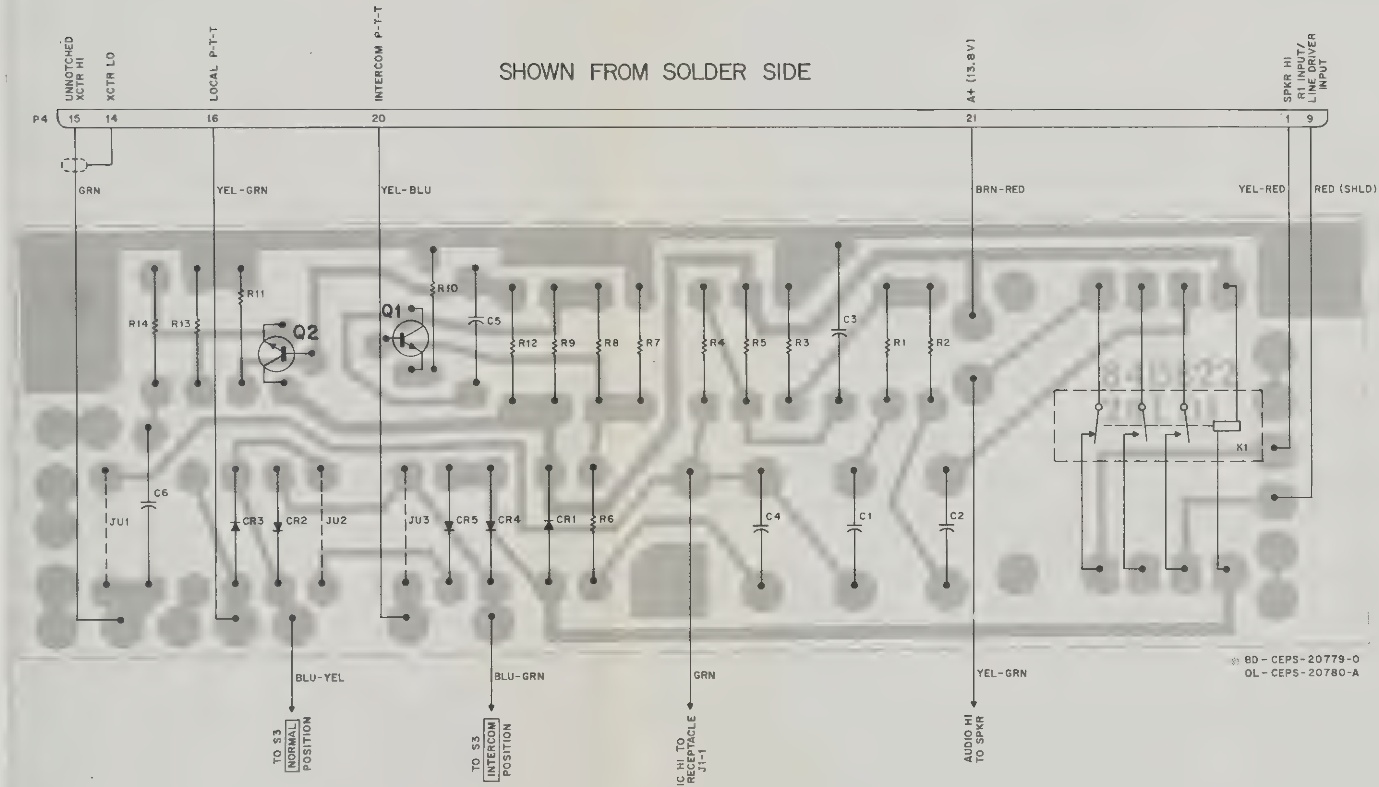
"COMPA–STATION" METERING & INTERCOM

PARTS LIST

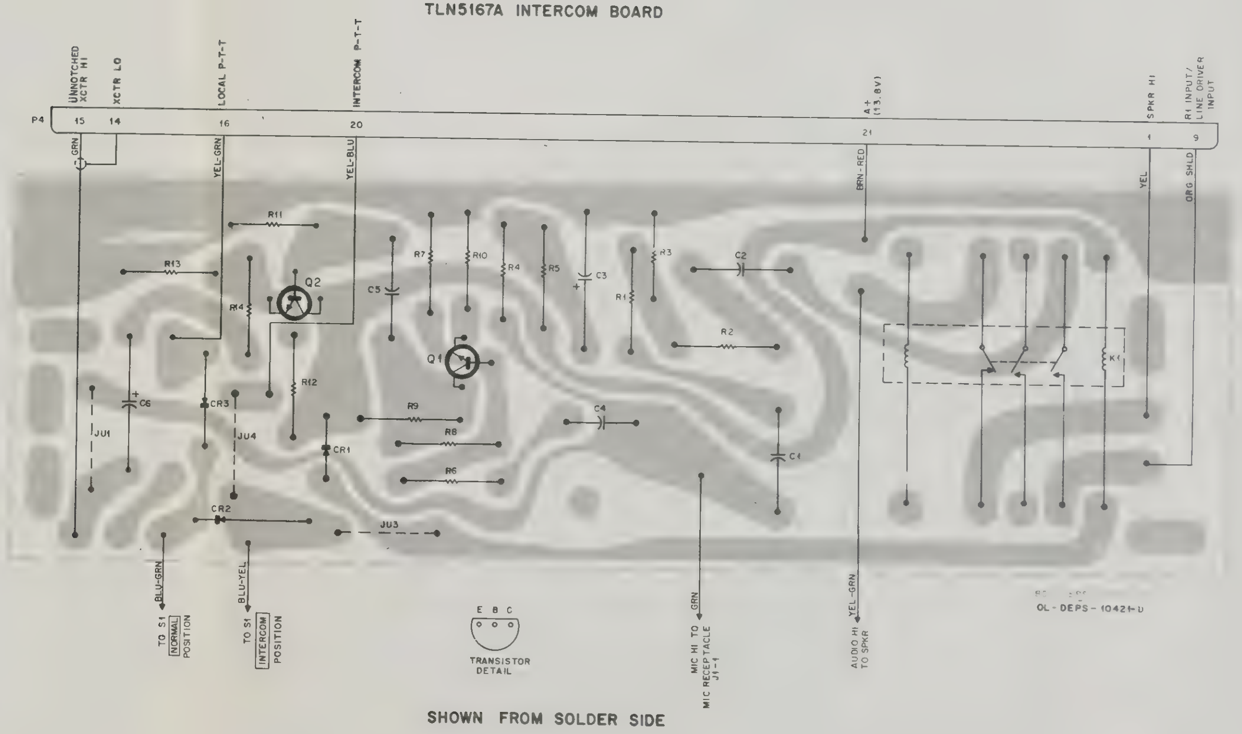
TLN5167A Intercom Board PL-5076-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF:
C1, 2	8-82905G11	0.22 ±10%; 50 V
C3	23-865137	4.7 ±20%; 25 V
C4, 5	8-82905G11	0.22 ±10%; 50 V
C6	23-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1 thru 5	48-83654H01	silicon
		SWITCH, magnetic reed: 13.4 V DC:
K1	80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1, 2	48-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W:
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

CURRENT VERSION


SHOWN FROM SOLDER SIDE
P4
UNNOTCHED XCTR HI
XCTR LO
LOCAL P-T-T
INTERCOM P-T-T
A+ (13.8V)
SPKR HI
R1 INPUT/ LINE DRIVER INPUT
15
14
16
20
21
1
9
GRN
YEL-GRN
YEL-BLU
BRN-RED
YEL-RED
RED (SHLD)
R14
R13
Q2
R11
Q1
R10
C5
R12
R9
R8
R7
R4
R5
R3
C3
R1
R2
K1
JU1
C6
CR3
CR2
JU2
JU3
CR5
CR4
CR1
R6
C4
C1
C2
BLU-YEL
BLU-GRN
GRN
YEL-GRN
TO S3 NORMAL POSITION
TO S3 INTERCOM POSITION
MIC HI TO MIC RECEPTACLE J1-1
AUDIO HI TO SPKR
BD-CEPS-20779-O
OL-CEPS-20780-A

EARLIER VERSION


TLN5167A INTERCOM BOARD
P4
UNNOTCHED XCTR HI
XCTR LO
LOCAL P-T-T
INTERCOM P-T-T
A+ (13.8V)
SPKR HI
R1 INPUT/ LINE DRIVER INPUT
15
14
16
20
21
1
9
GRN
YEL-GRN
YEL-BLU
BRN-RED
YEL
ORG SHLD
R11
R13
R14
Q2
C5
R7
R10
R4
R5
C3
R1
R3
C2
R2
K1
Q1
R12
C6
CR3
JU1
JU4
CR1
R9
R8
R6
C4
C1
CR2
JU3
BLU-GRN
BLU-YEL
YEL-GRN
TO S1 NORMAL POSITION
TO S1 INTERCOM POSITION
E B C
TRANSISTOR DETAIL
MIC HI TO GRN MIC RECEPTACLE J1-1
AUDIO HI TO SPKR
OL-DEPS-10421-O

SHOWN FROM SOLDER SIDE

"COMPA-STATION" METERING & INTERCOM

MODELS TLN1857A AND TLN1886A

INTERCOM

MODEL TLN1745A

FUNCTION

--Models TLN1857A and TLN1886A provide built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.

PARTS LIST

TLN5900A Meter Kit
TLN5993A Meter Kit

NOTE

This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

PL-5077-A

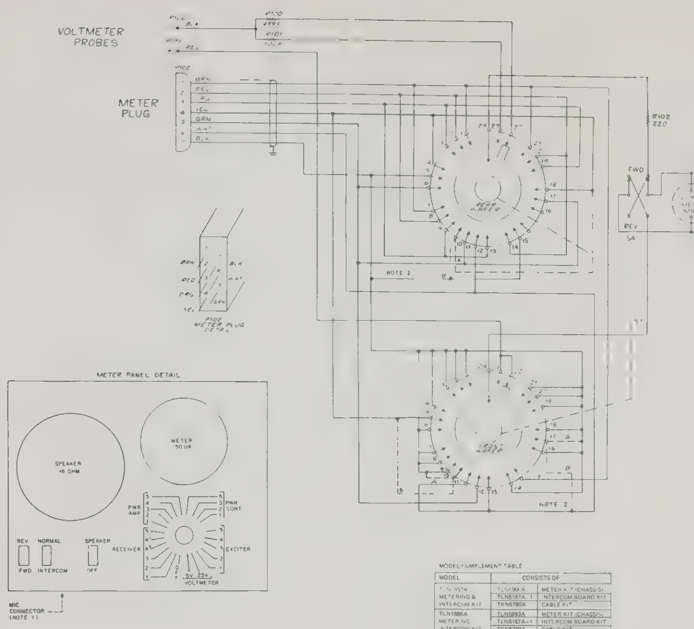
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
[illegible]	21-82428B24	.01 uF +80-20%; 500 V
		DIODE: (SEE NOTE)
CR100, 101	48-82420C03	silicon
		CONNECTOR, receptacle:
[illegible]	9-830418	4-contact
		LOUDSPEAKER: permanent:
[illegible]	50-84710G01	dynamic type; 3"; square 16 ohms voice coil impedance
		METER, dc:
[illegible]	72-83120C02	scale: 0-50 microamperes
		CONNECTOR, plug:
[illegible]	29-82676C01	test probe: BLACK
[illegible]	29-82676C02	test probe: RED
[illegible]	28-84208B01	7-contacts
		RESISTOR, fixed:
[illegible]	6-84640C61	499k ±0.5%; 1/4 W
[illegible]	6-137560D88	100k ±1%; 1/2 W
[illegible]	6-124A33	220 ohm ±5%; 1/4 W
[illegible]	17-82177B55	8 ±10%; 7 W
[illegible]	17-82177B44	13 ±10%; 15 W
		SWITCH:
[illegible]	40-83158C01	rotary; 2 section
[illegible]	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775B56	DIODE & CAPACITOR ASSEMBLY includes: DIODES CR100 & CR101 CAPACITOR C100
	1-80775B58	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine: 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4"; 2 used
	15-83947K01	COVER, connector; 2 used
	30-83678K01	CABLE, 7-conductor; 42" lg.
	42-83948K01	CLAMP, cable; 2 used
	1-80775B61	VOLTMETER PROBES includes: CONNECTOPS P100 & P101
	1-80792B23	SWITCH ASSEMBLY, wired (TLN5900A) includes: SWITCH S1
	1-80795B11	SWITCH ASSEMBLY, wired (TLN5993A) includes: SWITCH S1
	1-80792B24	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat: .128 x .250 x .033"; 2 used
	27-83008K03	CHASSIS, metering
	31-490181	TERMINAL STRIP: 2-terminal; 2 used
	31-823389	TERMINAL STRIP: 2 used
	42-871184	CLIP, mounting: 2 used SWITCHES S2, S3, & S4
	1-80793B04	COVER ASSEMBLY includes:
	1-80793B05	COVER SUBASSEMBLY includes:
	15-82734L01	COVER
	3-136138	SCREW, tapping: 6-32 x 3/8"; 2 used
	42-83123F01	RETAINER, screws; 2 used
	75-838826	BUMPER, rubber; 4 used
	2-7005	NUT, hex: 6-32 x 1/4 x 3/32"
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32"
	2-132616	NUT, hex: 6-32 x 1/4 x 3/32"; [illegible] used
	2-83896G01	NUT, special: 13/16-27 x .905 x .110"
	3-7331	SCREW, machine: 6-32 x 3/8
	3-129498	SCREW, machine: 6-32 x 5/16; 4 used
	3-134169	SCREW, tapping: 4-40 x 1/4; 6 used
	3-135111	SCREW, tapping: 4-40 x 3/8
	4-7568	WASHER, flat: .378 x .562 x .067"
	4-7650	WASHER, lock: #6 (internal tooth)
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)
	4-114057	WASHER, flat: .125 x .312 x .032"
	4-858060	WASHER, insulating: .125 x 7/32 x .060"; 3 used
	5-483208	GROMMET, rubber: 1/2" ID
	7-83198K01	BRACKET, meter
	14-84717F01	INSULATOR: .68 x .40"
	29-5247	LUG, soldering: #1/4 L; 2 used
	29-115147	LUG, soldering: #5
	35-84530G01	GRILLE, speaker
	36-84356C01	KNOB, pointer
	42-859067	CLAMP, cable: 1/2" OD (black)
	42-10217A02	STRAP, cable harness; 4 used
	42-82143C02	CLAMP, cable: 1/4" OD (black)
	54-83147L01	LABEL, caution

TKN6780A Cable Kit PL-3418-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P4	-	CONNECTOR: includes:
	9-84151B03	CONTACT, receptacle; 10 req'd
	14-84556B02	HOUSING
	NON-REFERENCED ITEM	
	42-10217A02	STRAP, cable harness; 7 used

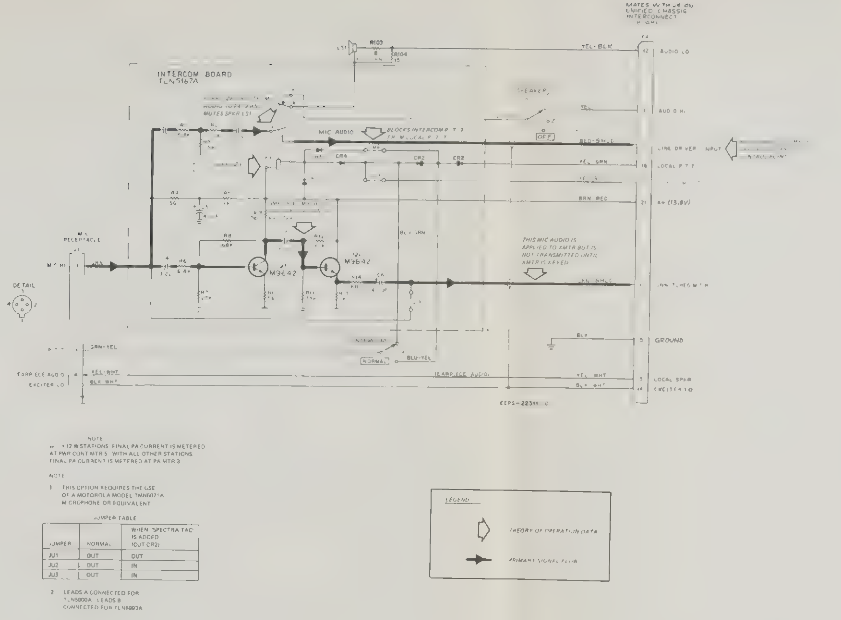
TRN6189A Intercom Chassis Kit PL-3452-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, receptacle:
[illegible]	9-830418	4-contact
		SPEAKER
[illegible]	50-84710G01	3"; 16 ohm
		RESISTOR, fixed; ±10%:
[illegible]	17-82177B55	8; 7 W
[illegible]	17-82177B44	13; 15 W
		SWITCH, slide:
[illegible]	40-11589	spst
	NON-REFERENCED ITEMS	
	1-80775B59	CHASSIS (riveted) incl. ref. item S2 and S3
	1-80775B51	COVER ASSEMBLY
	2-132616	LOCKNUT, speaker (No. 6-32) 4 req'd.
	2-83896G01	NUT, hex (used with J1)
	4-7699	LOCKWASHER (used with J1)
	5-483208	GROMMET, rubber
	35-84530G01	GRILLE, speaker
	42-82143C02	CLAMP, cable (1/4")
	42-10217A02	TY-WRAP, cable: 4 req'd.
	3-134169	SCREW, machine: No. 4-40 x 1/4"; 7 req'd.
	3-129498	SCREW, machine: No. 6-32 x 5/16"; 4 req'd.
	29-115147	LUG, solder (No. 5)
	31-823389	TERMINAL, strip; 2 used



MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF	
[illegible] METERING & INTERCOM KIT	[illegible]	METER KIT (CHASSIS)
	TLN5187A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1886A METERING INTERCOM KIT	TLN5993A	METER KIT (CHASSIS)
	TLN6187A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1745A INTERCOM KIT	TRN6189A	INTERCOM KIT (CHASSIS)
	TLN5187A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT



NOTE

* 12 W STATIONS FINAL PA CURRENT IS METERED AT PWR CONT MTR 5 WITH ALL OTHER STATIONS FINAL PA CURRENT IS METERED AT PA MTR 3

NOTE

1 THIS OPTION REQUIRES THE USE OF A MOTOROLA MODEL TMN6071A MICROPHONE OR EQUIVALENT

JUMPER TABLE

JUMPER	NORMAL	WHEN "SPECTRA TAC" IS ADDED (CUT CR2)
JU1	OUT	OUT
JU2	OUT	IN
JU3	OUT	IN

2 LEADS A CONNECTED FOR TLN5900A LEADS B CONNECTED FOR TLN5993A

OPERATING INSTRUCTIONS

1. METERING

Step 1. Select the function to be metered with the METER switch.

Step 2. Select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board or the power amplifier.

NOTE

> Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used.

Step 3. For receiver discriminator adjustment, use both 4(+) and 4(-) and adjust for meter zero.

Step 4. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 5. To measure miscellaneous station voltages, use the voltmeter probes (P100 and P101) on either the 5 V or 25 V positions. Divide the 5 V full scale reading by 10 to obtain actual voltage and divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speaker into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER-OFF switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the NORMAL position.

Step 4. The unit is now ready for "ON-THE-AIR" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER-OFF switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER-OFF switch in the SPEAKER position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

METER SELECT TABLE

P102 METER PLUG CONNECTED TO	METER SELECTOR SWITCH			LOW BAND MID BAND TLN1886A/TLN1887A		HIGH BAND TLN1857/TLN1859A		820 MHz UHF TLN1857A/TLN1859A	
	MTR	NO	POS	POL	FUNCTION METERED	POL	FUNCTION METERED	POL	FUNCTION METERED
RCVR AND F BOARD	RCVR	1	1	REV	EXTENDER CHANNEL ELEMENT	REV		FWD	CHANNEL ELEMENT OUTPUT
		2	2	REV	-	REV	-	FWD	FIRST DOUBLER [illegible]
		3	3	REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
		4+	4	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	[illegible]
		4-	5	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	[illegible]
		5	6	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	[illegible]
POWER AMP	PWR AMP	1	7	FWD	P A INPUT	REV	PA INPUT	FW	[illegible]
		2	8	FWD		REV	CONTROLLED AMP	[illegible]	[illegible]
		3	9	FWD		REV	[illegible]	[illegible]	[illegible]
		4	10	FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP	FWD	
		5	11	FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED ADJ STAGE VOLTAGE FINAL AMPLIFIER CURRENT 12 W ONLY
[illegible] CONTROL [illegible]	POWER CONT	5	12	FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADJ VOLTAGE ALL OTHERS
		3	13	FWD				FWD	ADJ VOLTAGE NOT USED [illegible]
		2	14	FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
		1	15	FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
			16		UNUSED		UNUSED		UNUSED
EXCITER	EXCTR	5	17	FWD	SECOND AMPLIFIER (LB) DRIVER INPUT (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
		4	18	FWD	FIRST AMPLIFIER (LB) DOUBLER INPUT (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
		3	19	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
		2	20	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
		1	21	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
	VOLT METER	25 V	22	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
		5 V	23	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0-50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0-50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0-50
	OFF		24		OFF		OFF		OFF

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PARTS LIST

TLN5901A Meter Kit
TLN5994A Meter Kit

NOTE

This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

PL-5078-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W: unless otherwise stated
R1		NOT USED
R2	17-82177B55	8; 7 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
S5	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775B55	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine: 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4" 2 used
	15-83947K01	COVER, connector: 2 used
	30-83678K01	CLAMP, cable; 2 used
		CONNECTOR P102
	1-80775B60	VOLTMETER PROBES includes:
		CONNECTORS P100 & P101
	1-80792B39	SWITCH ASSEMBLY, wired (TLN5901A)
	1-80795B12	SWITCH ASSEMBLY, wired (TLN5994A) includes:
		SWITCH S1
	1-80793B03	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat: .128 x .250 x .033"; 3 used
	27-83400K02	CHASSIS, metering
	29-115147	LUG, soldering: #5
	31-490101	TERMINAL STRIP: 2-terminal; 2 used
	42-871184	CLIP, mounting; 3 used
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32
	2-115190	NUT, hex: 15/32-32 x 9/16 x 5/64"
	2-121841	NUT, hex: 6-32 x 5/16 x 7/64"
	2-83896G01	NUT, special: 13/16-27 x .905 x .110"
	3-134185	SCREW, tapping: 6-32 x 1/4: 2 used
	3-134212	SCREW, tapping: 4-40 x 5/16; 3 used
	3-136934	SCREW, tapping: 6-32 x 3/8"
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)
	4-8324	WASHER, lock: #15/32 (split)
	14-84717F01	INSULATOR: .68 x .40"
	29-5279	LUG, soldering: #7/8
	31-835961	TERMINAL STRIP, 18-terminal
	36-82630H01	KNOB, control
	42-890499	CLAMP, cable: 3.18 x .62"
	42-10217A02	STRAP, cable harness

TKN6886A Cable Kit PL-5207-A

		CONNECTOR:
P4	-	includes:
	9-84151B03	CONTACT, receptacle: 12 used
	14-84556B02	HOUSING, connector
	NON-REFERENCED ITEMS	
	14-859051	INSULATOR, lug: .315 x .945"; 6 used
	29-5247	LUG, soldering: #1/4 L; 4 used
	29-824456	LUG, ring tongue: 2 used
	29-859118	LUG, receptacle: .295 x .750"; 6 used
	37-82603D60	SLEEVE, numbered; blank
	39-10184A24	CONTACT, female
	42-10217A02	STRAP, cable harness; 3.62" lg.; 28 used
	42-10217A10	STRAP, cable harness; 7.78" lg.; 4 used
	9-84234E10	JACK, test; white; 3 used

TLN5134A Meter Panel PL-2233-A

		LIGHT, indicator:
DS1	65-83183G02	includes lamp and GRN lens
DS2	65-83183G04	includes lamp and RED lens
		LOUDSPEAKER, permanent magnet:
LS1	50-83562A01	dynamic type; 4"; square; 4 ohms voice coil impedance
		METER, electrical: 50 uA movements:
M1	72-84864B10	scale: 0-25 volts/amps
M2	72-84864B09	scale: 0-50 microamperes
	NON-REFERENCED ITEMS	
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining; 2 used
	2-7009	NUT, hex: 10-32 x 3/8 x 1/8"; 4 used
	3-119916	SCREW, machine: 10-32 x 7/16" 4 used
	3-131964	SCREW, tapping: 6-32 x 3/8; 12 used
	4-7658	WASHER, lock: #10 (split); 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

UPRIGHT STATION METERING & INTERCOM

MODELS TLN1859A AND TLN1887A

FUNCTION

Provides built-in metering of over 20 major test points in the transmitter and receiver(s). Plus intercom between the station and the remote control point.

METER SELECT TABLE

P102 METER PLUG CONNECTED TO	METER SELECTOR SWITCH			LOW BAND—MID BAND TLN1886A/TLN1887A		HIGH BAND TLN1857/TLN1858A		820 MHz/UHF TLN1857A/TLN1859A	
	MTR	NO.	POS	POL	FUNCTION METERED	POL	FUNCTION METERED	POL.	FUNCTION METERED
RCVR AND IF BOARD	RCVR	1	1	REV	EXTENDER CHANNEL ELEMENT	REV	–	FWD	CHANNEL ELEMENT OUTPUT
		2	2	REV	–	REV	–	FWD	FIRST DOUBLER OUTPUT
		3	3	REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
		4+	4	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		4–	5	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		5	6	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
POWER AMP	PWR AMP	1	7	FWD	P.A. INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
		2	8	FWD	–	REV	CONTROLLED AMP OUTPUT	FWD	25 W DRIVER CURRENT (75 W)
		3	9	FWD	–	REV	INPUT FINAL AMP 90/100 W/60 W PREDRIVER	FWD	FINAL AMP CURRENT (EXCEPT 12 W MODELS)
		4	10	FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP	FWD	–
		5	11	FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED (ADL) STAGE VOLTAGE FINAL AMPLIFIER CURRENT (12 W ONLY)
POWER CONTROL BOARD	POWER CONT	5	12	FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADL VOLTAGE (ALL OTHERS)
		3	13	FWD	–		–	FWD	ADL VOLTAGE NOT USED (800 MHz ONLY)
		2	14	FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
		1	15	FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
			16		UNUSED		UNUSED		UNUSED
EXCITER	EXCTR	5	17	FWD	SECOND AMPLIFIER – (LB) DRIVER INPUT (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
		4	18	FWD	FIRST AMPLIFIER – (LB) DOUBLER INPUT – (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
		3	19	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
		2	20	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
		1	21	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
	VOLT-METER	25 V	22	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
		5 V	23	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50
	OFF	-	24		OFF		OFF		OFF

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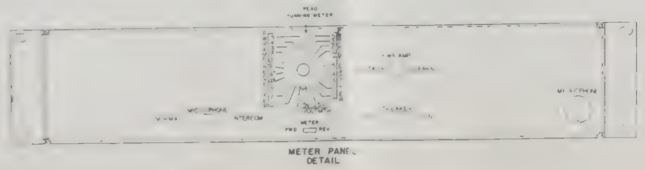
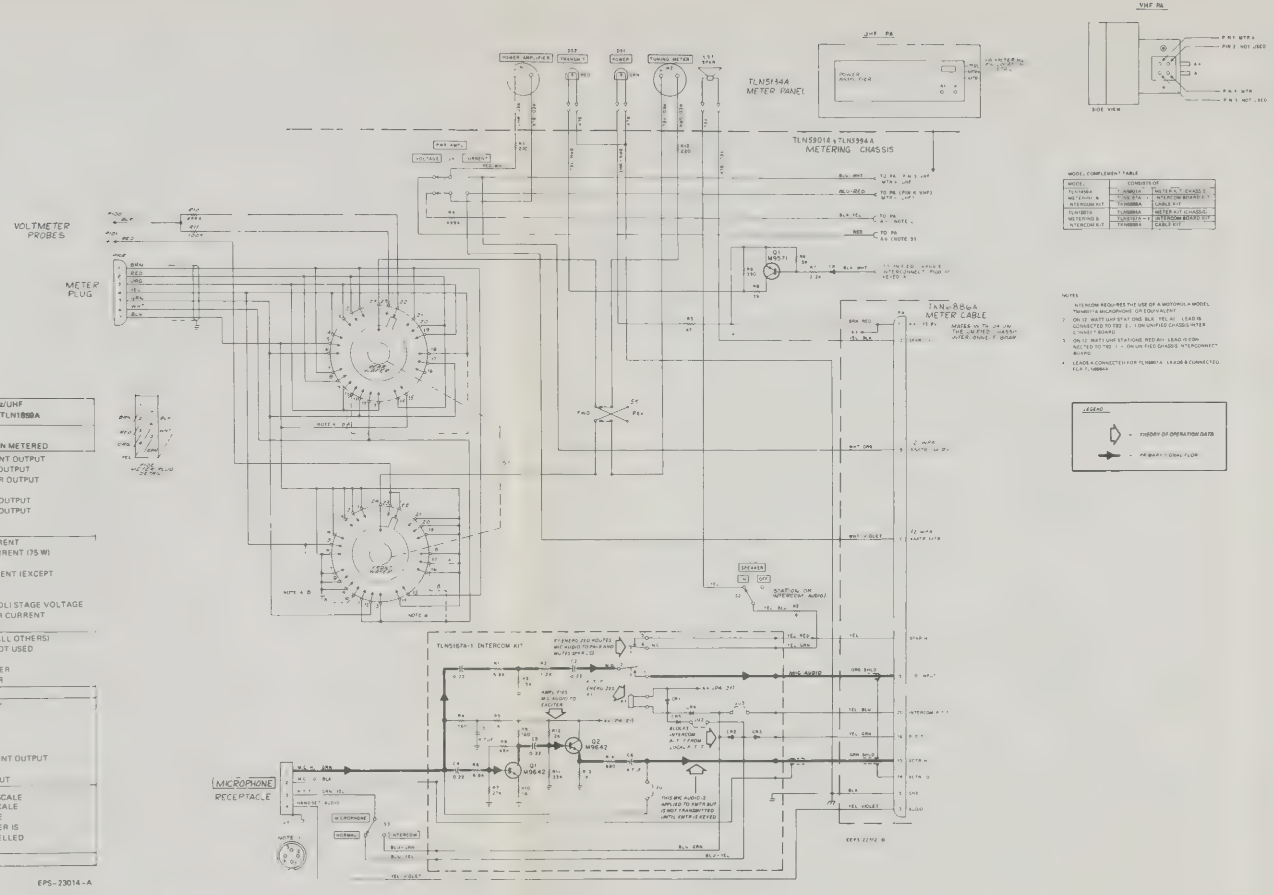


METER PANEL DETAIL



OPERATING INSTRUCTIONS

1. METERING

Step 1. Tuning Meter Usage -- Select the function to be metered with the meter switch. Next, select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board, or the power amplifier. NOTE: Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used. For receiver discriminator adjustment, use both 4(+) and 4(-) and adjust for meter zero.

Step 2. PWR AMP Meter Usage -- Select PA current/voltage monitoring by placing the VOLTAGE/CURRENT switch in the applicable position.

Step 3. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 4. Voltmeter Usage -- Use either the 5 V or 25 V scales as applicable. Divide the 5 V full scale reading by 10 to obtain actual voltage. Divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM in the NORMAL position.

Step 4. The unit is now ready for "on-the-air" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER switch in the ON position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

PARTS LIST

TLN5901A Meter Kit
TLN5994A Meter Kit

NOTE

This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

PL-5078-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W unless otherwise stated
R1		NOT USED
R2	17-82177B55	8; 7 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
S5	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775B55	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine: 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4" 2 used
	15-83947K01	COVER, connector; 2 used
	30-83678K01	CLAMP, cable; 2 used
		CONNECTOR P102
	1-80775B60	VOLTMETER PROBES includes: CONNECTORS P100 & P101
	1-80792B39	SWITCH ASSEMBLY, wired (TLN5901A)
	1-80795B12	SWITCH ASSEMBLY, wired (TLN5994A) includes: SWITCH S1
	1-80793B03	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat: .128 x .250 x .033"; 3 used
	27-83400K02	CHASSIS, metering
	29-115147	LUG, soldering: #5
	31-490101	TERMINAL STRIP: 2-terminal; 2 used
	42-871184	CLIP, mounting; 3 used
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32
	2-115190	NUT, hex: 15/32-32 x 9/16 x 5/64'
	2-121841	NUT, hex: 6-32 x 5/16 x 7/64
	2-83896G01	NUT, special: 13/16-27 x .905 x .110'
	3-134185	SCREW, tapping: 6-32 x 1/4; 2 used
	3-134212	SCREW, tapping: 4-40 x 5/16; 3 used
	3-136934	SCREW, tapping: 6-32 x 3/8"
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	[illegible]	WASHER, lock: #15/32 (split)
	14-84717F01	INSULATOR: .68 x .40
	[illegible]	[illegible]
	[illegible]	TERMINAL STRIP, 18-terminal
	36-82630H01	KNOB, control
	[illegible]	CLAMP, cable 3.18 x .62
	42-10217A02	STRAP, cable harness

TKN6886A Cable Kit

[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]
		lg., 28 used
	[illegible]	STRAP, cable harness, 7.78 lg., 4 used

R1	65-83183G02	[illegible]
R2	65-83183G04	[illegible]
[illegible]	50-83562A01	[illegible]
[illegible]	72-84864B10	[illegible]
	NON-REFERENCED ITEMS	
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining, 2 used
	[illegible]	NUT, hex: 10-32 x 3/8 x 1/8 4 used
	[illegible]	SCREW, machine: 10-32 x 7/16 4 used
	[illegible]	SCREW, tapping: 6-32 x 3/8, 12 used
	[illegible]	WASHER, lock: #10 (split); 4 used
	[illegible]	FRAME, top
	[illegible]	FRAME, bottom
	[illegible]	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

MOTOROLA INC.
Communications
Sector

EXCITER

MODEL TLF1192A

Model Complement

Model	Description
TLD5322B	Exciter
TFD6442A	VHF Helical Filter

Technical Characteristics

Frequency	Model TLD5322B: 154.6-160 MHz
Number of Channels	1 to 4
Maximum Frequency Separation	±750 kHz
Oscillator Frequency	12.8-13.3 MHz
Frequency Multiplication	12 times
Output Power	400 milliwatts
Output Impedance	50 ohms
Modulator Type	Direct FM
Deviation	±5 kHz, adjustable instantaneous deviation limiting
Audio Response	6 dB/octave pre-emphasis 300 to 3000 Hz
Audio Sensitivity	165 millivolts for ±3.0 kHz deviation
Audio Distortion	Less than 3% at ±3.0 kHz deviation from 300 to 3000 Hz
Power Requirements	Regulated +9.6 volts dc @150 mA +13.6 volts dc @100 mA
Construction Metering	Fully solid-state. Five test points critical to operation and alignment are accessible at a metering receptacle which permits testing with an optional built-in station meter, Motorola portable test set, or 0-50 uA microammeter with 2,000 ohms series resistance.

1. DESCRIPTION

1.1 The TLN5322B Exciter provides the low power excitation for an FM transmitter. Plug-in channel elements are used to develop a direct FM carrier signal of at least 400 milliwatts.

1.2 The exciter is directly frequency-modulated for crystal-controlled frequency operation in the 154.6-160 MHz range. It consists of a symmetrical clipper and splatter filter, emitter follower, channel element(s) (voltage controlled crystal oscillator), buffer amplifier, tripler, first doubler, second doubler, and output amplifier. The fundamental crystal frequency is multiplied by twelve to provide the final output frequency.

1.3 When the exciter is used in *Private-Line* squelch stations, a *Private-Line* squelch encoder circuit board is plugged directly into the mating pins of the exciter; and one jumper (JU402) is removed from the exciter; no interconnecting wires are used. The exciter board also includes additional pins that permit the board to be used with certain types of optional equipment. These pins are designated P403 on the exciter schematic diagram.

2. FUNCTIONAL OPERATION

Refer to Figure 1 and the Exciter schematic diagram included in this section.

2.1 DEVIATION LIMITING CIRCUIT

2.1.1 Microphone output audio is applied to the symmetrical clipper and splatter filter. This circuit, together with amplifier U401, provides pre-emphasis, amplification, and limiting of the microphone audio. Microphone audio is then applied to emitter follower Q401 (together with PL code) through the IDC (Instantaneous Deviation Control) potentiometer to the channel elements.

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2.1.2 The output of the emitter follower is developed across IDC potentiometer R410. This audio signal can be monitored at pin 1 of the exciter metering receptacle. The potentiometer adjusts the maximum level of audio coupled to the oscillator-modulator, thus setting the amount of deviation.

2.1.3 In *Private-Line* squelch radios, a low amplitude *Private-Line* code is continuously injected into the oscillator-modulator from the *Private-Line* squelch encoder. This code range produces 0.5 to 1.0 kHz deviation.

2.2 MODULATOR-OSCILLATOR STAGE (CHANNEL ELEMENT)

2.2.1 The combination modulator-oscillator stage (channel element) produces a low-power crystal frequency signal modulator at an audio rate. This signal is multiplied twelve times and amplified in following stages to produce the carrier signal. The channel element consists of a parallel combination varactor and warping capacitor connected in series with a crystal. A change in capacitance seen at the crystal terminals causes the crystal to vary its resonant frequency in proportion to the capacitance change. The audio voltage from the audio and IDC circuitry is applied to the varactor to cause a change in capacitance; this variation in turn causes the frequency to change at the same audio rate.

2.2.2 Frequency generation is accomplished with either ovenized crystal controlled oscillator (channel elements) or a frequency synthesizer with ultra high stability for simulcast applications. A variable warp capacitor in the base of each channel element is accessible for fine frequency adjustment. Each channel element is a factory sealed, plug-in module which provides a train of stable frequency positive pulses.

2.2.3 The exciter accepts a signal from either the ovenized oscillator or frequency synthesizer. A power input of +9.6 volts is applied to the channel element continuously while the station is turned ON. Channel element output is developed only when a switched ground generated by the local or remote control unit is present. An indication of the channel element output is available at pin 2 of the metering socket. This allows channel element operation to be easily checked with optional built-in station metering or with a Motorola Portable test set.

NOTE

If the station is equipped with a time-out timer module and the time times out, keyed A− is removed from the modulator-oscillator(s) and the entire transmitter is shut down.

2.3 BUFFER AMPLIFIER

The buffer amplifier, Q404, is biased to operate as a Class A amplifier and provides reserve gain to isolate the modulator-oscillator from the succeeding stages.

2.4 MULTIPLIERS AND EXCITER POWER AMPLIFIER

2.4.1 The multipliers develop an output signal that is 12 times the channel element frequency and a final power amplifier gives power gain and matches the output impedance to 50 ohms.

2.4.2 The buffer amplifier output is developed across two parallel resonant tank circuits at the channel element frequency. Tripler Q405 operates as a Class C amplifier with its parallel resonant output tuned to the their harmonic of its input. Thus the output of the tripler is three times the channel element frequency. A

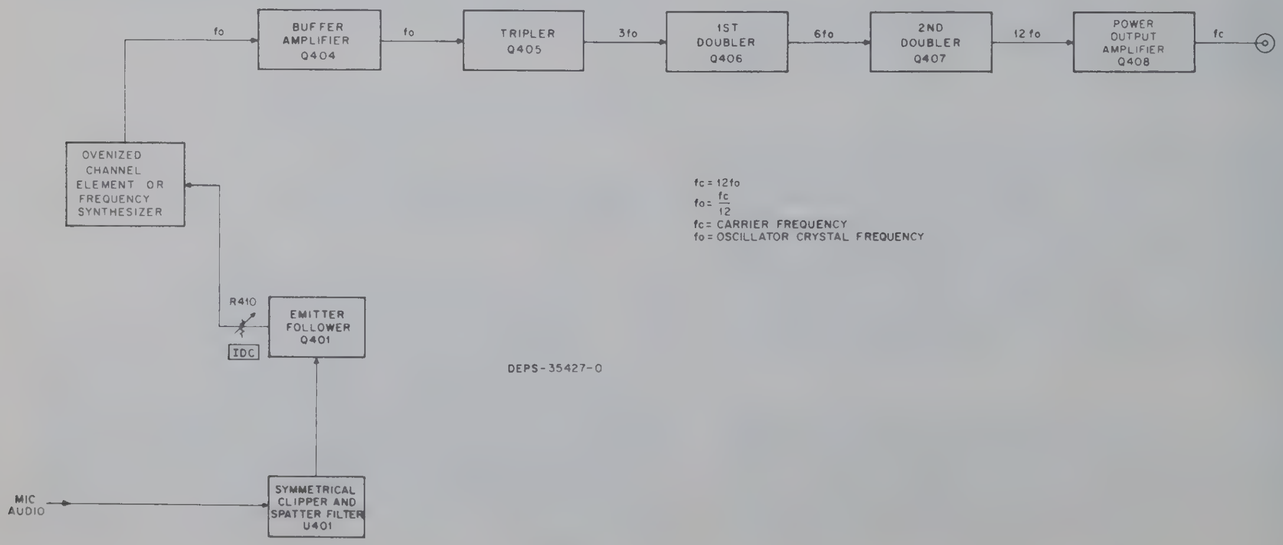


Figure 1. Exciter Block Diagram

meter connected at pin 3 of the metering receptacle measures the average dc base current which is proportional to input signal strength.

2.4.3 The first doubler circuit operates very similar to the tripler except its output is tuned to the second harmonic of its input and its drive is metered at pin 4. The output of the doubler is six times the channel element frequency.

2.4.4 The second doubler circuit also operates similar to the tripler with its output tuned to the second harmonic of its input. The drive to the second doubler is metered on pin 5 of the metering receptacle. The output signal is 12 times the channel element frequency and is the carrier frequency of the transmitter.

2.4.5 The exciter power amplifier also operates as a Class C amplifier. The amplifier provides at least 400 milliwatts of frequency modulated signal at the carrier frequency to the power amplifier section of the transmitter.

3. MAINTENANCE

3.1 METERING

The exciter is equipped with a metering receptacle which allows five major test points to be measured. The output of the exciter (input to the power amplifier) can be measured by using the metering receptacle on the power amplifier. With the portable test set connected to the metering receptacles, or by using the built-in station metering kit (if so equipped), readings may be made at each of the major test points in the circuit by merely rotating a selector switch. A failure in almost any portion of the exciter produces a low or zero meter reading for one or more of the test points. Improper alignment also causes improper meter readings.

NOTE

The exciter board must be installed in the transmitter for testing to provide the necessary power, ground, control and signal connections. The circuit board should always be secured in place with all mounting screws for operation and testing to provide good rf ground to all stages of the exciter. The exciter may be tested while installed in the station — usually the preferred method. However, if desired, it can be bench tested in a *Micor* mobile radio, except that the time-out timer is inoperative.

3.1.1 Built-In Station Metering

Step 1. The output of the exciter must be terminated into its normal point, the bandpass filter. The output of the power amplifier must be terminated in a 50-ohm dummy load or an antenna.

Step 2. Turn station ON.

Step 3. Set selector switch to position 1. Key the transmitter and whistle into the microphone long enough to observe the metering reading.

Step 4. Set selector switch to positions 2, 3, 4, and 5 respectively, keying the transmitter and observing the meter readings for each position (whistling not required). On multi-frequency stations, repeat the readings for each exciter frequency. An analysis of the meter readings for determining whether each circuit is good or bad follows in the Performance Tests paragraph.

3.1.2 Portable Test Set

Step 1. Connect the 20-pin plug of the test set adapter cable to the test set. When the test set is not is use, disconnect the 20-pin plug to conserve battery life. The plug acts as an on-off switch completing the battery circuit.

Step 2. Connect the red "control" plug of the adapter cable to the control receptacle on the local or remote control circuit board. Connect the white "metering" plug of the adapter cable to the metering receptacle on the exciter circuit board.

Step 3. Set function selector switch to the XMTR position.

Step 4. Set oscillator and meter reversing switch to OFF postion.

Step 5. Set 1 V-100 mV switch on the adapter cable to the 100 mV position (TEK-37). On the later version adapter cable (TEK-37A), the switch is omitted and the unit operates at 100 mV sensitivity.

Step 6. Set the REF A-B switch on the adapter cable to position A.

Step 7. The output of the exciter must be terminated into its normal point, the bandpass filter. The output of the power amplifier must be terminated in a 50-ohm dummy load or an antenna.

Step 8. Turn station ON.

Step 9. Connect a microphone to the microphone receptacle on the portable test set or to the local or remote control board.

Step 10. Set selector switch to position 1. Key the transmitter and whistle into the microphone long enough to observe the meter reading.

Step 11. Set selector switch to positions 2, 3, 4, and 5 respectively, keying the transmitter with the XMTR ON pushbutton on the test set or the push-to-talk switch on

Typical Exciter Meter Readings

Selector Switch Position	Reference Switch Position (Test Set Only)	Reading	Circuit Metered	If Low, the Defective Circuit Is
1	A	2 (no mod); 6 (1 V rms @1 kHz exciter board pins 1 & 12)	Audio output of IDC circuit	IDC circuit
2	A	25	Channel element output	Channel element
3	A	38	Tripler input	Modulator or Tripler
4	A	22	1st doubler output	Tripler or 1st doubler
5	A	25	2nd doubler input	1st doubler or 2nd doubler

the microphone and observing the meter reading for each position. On multi-frequency stations, repeat the readings for each exciter frequency. An analysis of the meter readings for determining whether each circuit is good or bad follows in the Performance Tests paragraph.

Step 12. Move the "metering" plug to the power amplifier metering receptacle and observe the meter readings for selector switch position 1. The reference A-B switch must be set to the B position and the metering reversing switch to METER REV.

Each time maintenance is performed on the exciter, the readings should be compared with the previous set of readings. Any degradation of performance will quickly be noted.

3.2 PERFORMANCE TESTS

The performance tests may be used for troubleshooting to isolate the point of abnormal performance. They may also be used after repair and alignment to assure that the exciter meets all specifications before it is returned to service.

3.2.1 Power Output Test

Step 1. Connect the equipment as connected for metering (paragraph 3.1), except connect the test set "metering" plug to the power amplifier metering receptacle.

Step 2. Set selector switch to position 1. This checks the input to the power amplifier (output of the exciter). A meter reading of at least 20 uA equals an rf signal level of 400 milliwatts.

Step 3. On multi-frequency stations of ±750 kHz separation, repeat the test for each exciter frequency. Select the frequency to be tested by the frequency selector switch associated with the station. The test set meter should indicate at least 20 uA for each frequency.

3.2.2 Frequency Test

Step 1. Terminate the transmitter in an antenna and measure the radiated signal with a Motorola digital frequency meter and deviation monitor or other highly accurate frequency measuring device (±.00005% or better).

NOTE

When high stability channel elements are used, carrier frequency must be within .0002%.

Step 2. Key the transmitter to produce an unmodulated carrier signal. In *Private-Line* tone-coded stations disable the *Private-Line* encoder by unplugging the VIBRASENDER™ resonant reed. In *Digital Private-Line* stations, disable the code by shorting together the two "code disable" pins on the PL encoder board.

NOTE

Do not use the push-to-talk switch on the microphone. Background noise will modulate the signal.

Step 3. Read the transmitter output frequency. On multi-frequency stations, repeat the test for each frequency.

Step 4. If adjustment is required, set the "warp" capacitor on the associated channel element for the assigned frequency output. For best accuracy, the radio set should be brought to room temperature (+70° to 75°F) and the test equipment thoroughly warmed up. This brings the channel element to the center of its temperature compensation range.

3.2.3 Deviation Test

Step 1. Terminate the transmitter output in an antenna and measure the radiated signal with a deviation meter.

Step 2. In *Private-Line* tone-coded squelch stations, re-insert the *Vibrasender* resonant reed if it was removed in the previous test. In *Digital Private-Line* stations, remove the code disable short. Key the transmitter with only *Private-Line* code modulation. The deviation meter should indicate 0.5 to 1 kHz.

Step 3. Connect an audio oscillator output to exciter board pins 1 (Gnd) and 12 (Audio High). Adjust the audio oscillator to 1000 Hz and 1 V as measured on an ac voltmeter. The deviation meter should indicate ±5 kHz deviation.

Step 4. Adjust the audio oscillator over the entire 300 to 3000 Hz range, keeping the audio level at approximately 1 V. The deviation meter should never exceed ±5 kHz nor drop below ±2.5 kHz.

3.2.4 Audio Sensitivity Test

Step 1. After completion of the Deviation Test, reduce the output of the audio osciillator to 130 millivolts at 1000 Hz.

Step 2. The deviation meter should indicate approximately ±3.0 kHz. Meter position 1 may be noted at this time for future reference. Future audio sensitivity checks may then be made by comparing the meter 1 reading with the reference value.

3.3 TROUBLESHOOTING

3.3.1 If there are no test set indications at one or more of the metered points, check the dc input voltages to the exciter circuit board.

P402-11 & 13	+9.6 volts in respect to chassis
P402-6	Keyed A− (approximately −13.6 volts in respect to A+, pin 7)

3.3.2 If test set indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltage.

NOTE

In *Private-Line* stations, the transmitter cannot be keyed if the PL encoder is removed unless a jumper (JU402) is connected from pin 8 to pin 10 of the exciter to complete the keying circuit. This jumper is permanently connected in exciters for non-*Private-Line* operation.

parts list

TFD6442A VHF Helical Filter PL-8274-O

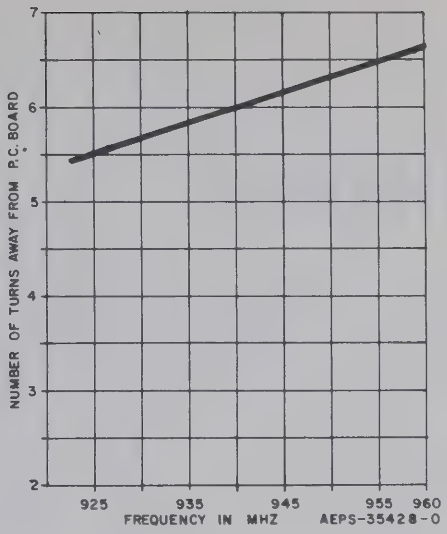
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor:
C1, C2	21-83406D68	27 pF; ± 5%
		coil:
L1, L2, L3	24-84418C02	rf coil
	non-referenced items	
	3-134212	SCREW, tapping; 4-40 × 5/16"; 6 req'd.
	3-138081	SCREW, set; 10-32 × 1-1/16"; 3 req'd.
	7-84098K01	BRACKET, mounting
	9-82615F01	JACK, phono
	41-84410B01	SPRING, torque; 3 req'd.
	15-84097K01	HSNG CAVITY
	9-84135B02	JACK, phono
	64-84099K01	TOP, plate
	84-84100K01	Circuit Board

TRN6192A Transmitter Shield Kit PL-8214-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-139495	SCREW, tapping; 6-32 × 5/16"; 5 used
	26-82832K01	SHIELD

Step	Adjust	Metering Plug Location
1		
2	POWER SET	
3	FREQUENCY SWITCH	EXCITER
4	ALL EXCITER COILS	EXCITER
5	L401	EXCITER
6	L401, L402	EXCITER
7	L403	EXCITER
8	L403, L404	EXCITER
9	L405	EXCITER
10	L405, L406	EXCITER
11	L407, L408	EXCITER
12	L407, L408	PA
13		
14		

Alignment may be performed using a M
metering. The OSC & METER REV
automatically reversed as required when
thousand ohm equivalent series resistan
resistance must have their readings corre



ENCY ADJUSTMENT

nitter with the XMTR ON pushbutton on the portable test
e stations, unplug the *Vibrasender* resonant reed from the
hort together the code disable pins on the *Digital Private-*

e selected channel to the exact desired frequency. On
nt warp capacitor. On multi-frequency models, adjust the
ctor switch setting; repeat for each frequency.

IENT PROCEDURES

TE

must be measured with a Motorola R1200
iation Meter Plug-In Module that has been
1 Hz, or equivalent.

before setting "IDC". Connect the audio oscillator to the

ne *Private-Line* models, replace the *Vibrasender* resonant
from the code disable pins.

kHz deviation.

ally full deviation should still be indicated. Less than full

EXCITER

Exciter Alignment Procedure
and Troubleshooting Chart
Motorola No. ***PEPS-35502-O***
12/1/82-UP

parts list

TFD6442A VHF Helical Filter PL-8274-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor:
C1, C2	21-83406D68	27 pF; ±5%
		coil:
L1, L2, L3	24-84418C02	rf coil
		non-referenced items
	3-134212	SCREW, tapping; 4-40 × 5/16"; 6 req'd.
	3-138081	SCREW, set; 10-32 × 1-1/16"; 3 req'd.
	7-84098K01	BRACKET, mounting
	9-82615F01	JACK, phono
	41-84410B01	SPRING, torque; 3 req'd.
	15-84097K01	HSNG CAVITY
	9-84135B02	JACK, phono
	64-84099K01	TOP, plate
	84-84100K01	Circuit Board

TRN6192A Transmitter Shield Kit PL-8214-O

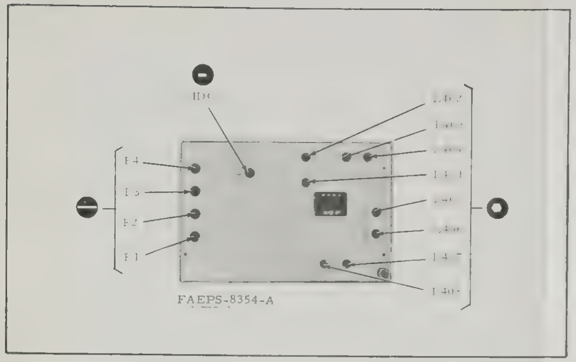
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-139495	SCREW, tapping; 6-32 × 5/16"; 5 used
	26-82832K01	SHIELD

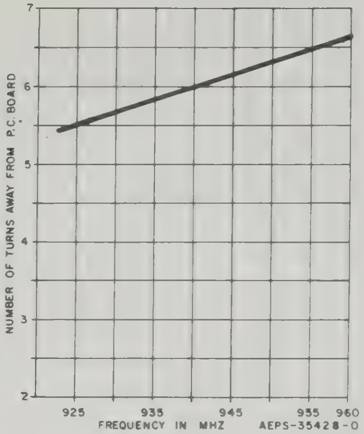
Alignment Procedure

Step	Adjust	Metering Plug Location	Selector Switch Position	Meter Rev. Switch and Ref A-B Switch (See Note)	Stage and Procedure
1					SET UP — Key the transmitter with the XMTR ON pushbutton on the portable test set.
2	POWER SET				OUTPUT — Turn the POWER SET control fully counterclockwise. Unkey the transmitter.
3	FREQUENCY SWITCH	EXCITER	2	OFF REF A	CHANNEL ELEMENT — Select the desired frequency on multi-frequency stations. Key the transmitter. The test set meter 2 should indicate at least 10 uA.
4	ALL EXCITER COILS	EXCITER	5	OFF REF A	PRE-ALIGNMENT — If the exciter is completely untuned and shows no meter 5 readings, set cores of tuning coils L401 to L406 to the top of their coil forms (away from circuit board). Set cores of L407 and L408 per the exciter pre-tuning chart. If a meter 5 reading is available proceed to Step 7.
5	L401	EXCITER	2	OFF REF A	BUFFER OUTPUT — Tune L401 for minimum meter reading.
6	L401, L402	EXCITER	3	OFF REF A	BUFFER OUTPUT — Tune L402 and then L401 for peak meter reading.
7	L403	EXCITER	3	OFF REF A	TRIPLER OUTPUT — Tune L403 for minimum meter reading.
8	L403, L404	EXCITER	4	OFF REF A	TRIPLER OUTPUT — Tune L404 and then L403 for peak meter reading.
9	L405	EXCITER	4	OFF REF A	FIRST DOUBLER OUTPUT — Tune L405 for minimum meter reading.
10	L405, L406	EXCITER	5	OFF REF A	SECOND DOUBLER OUTPUT — Tune L406, and then L405 for peak meter reading.
11	L407, L408	EXCITER	5	OFF REF A	EXCITER OUTPUT — Tune L407 then L408 for peak meter reading.
12	L407, L408	PA	1	METER REV REF A	EXCITER OUTPUT — Move the metering plug to the PA. Tune L408 and then L407 for peak meter reading.
13					Repeat Steps 6, 8 and 10.
14					Align the power amplifier.

NOTE

Alignment may be performed using a Motorola S1056 thru S1059 Portable Test Set or optional built-in station metering. The OSC & METER REV SWITCH column refers to portable test set usage — polarity is automatically reversed as required when built-in station metering is used. All meter readings are based on a two-thousand ohm equivalent series resistance in the meter. Therefore, meters not having a two-thousand ohm series resistance must have their readings corrected.





OSCILLATOR FREQUENCY ADJUSTMENT

1. Key the transmitter with no modulation (key the transmitter with the XMTR ON pushbutton on the portable test set rather than with the microphone). On *Private-Line* stations, unplug the *Vibrasender* resonant reed from the PL tone generator. On *Digital Private-Line* stations short together the code disable pins on the *Digital Private-Line* encoder board.

2. Adjust the channel element warp capacitor for the selected channel to the exact desired frequency. On single-frequency models, adjust the F1 channel element warp capacitor. On multi-frequency models, adjust the warp capacitor which corresponds to the frequency selector switch setting; repeat for each frequency.

"IDC" ADJUSTMENT PROCEDURES

NOTE

For *Digital Private-Line* stations, deviation must be measured with a Motorola R1200 Series Service Monitor with RTC-4000 Deviation Meter Plug-In Module that has been modified for frequency response of less than 1 Hz, or equivalent.

1. Each channel element must be "warped" on frequency *before* setting "IDC". Connect the audio oscillator to the exciter input (pins 1, GND, and 12, Audio High).

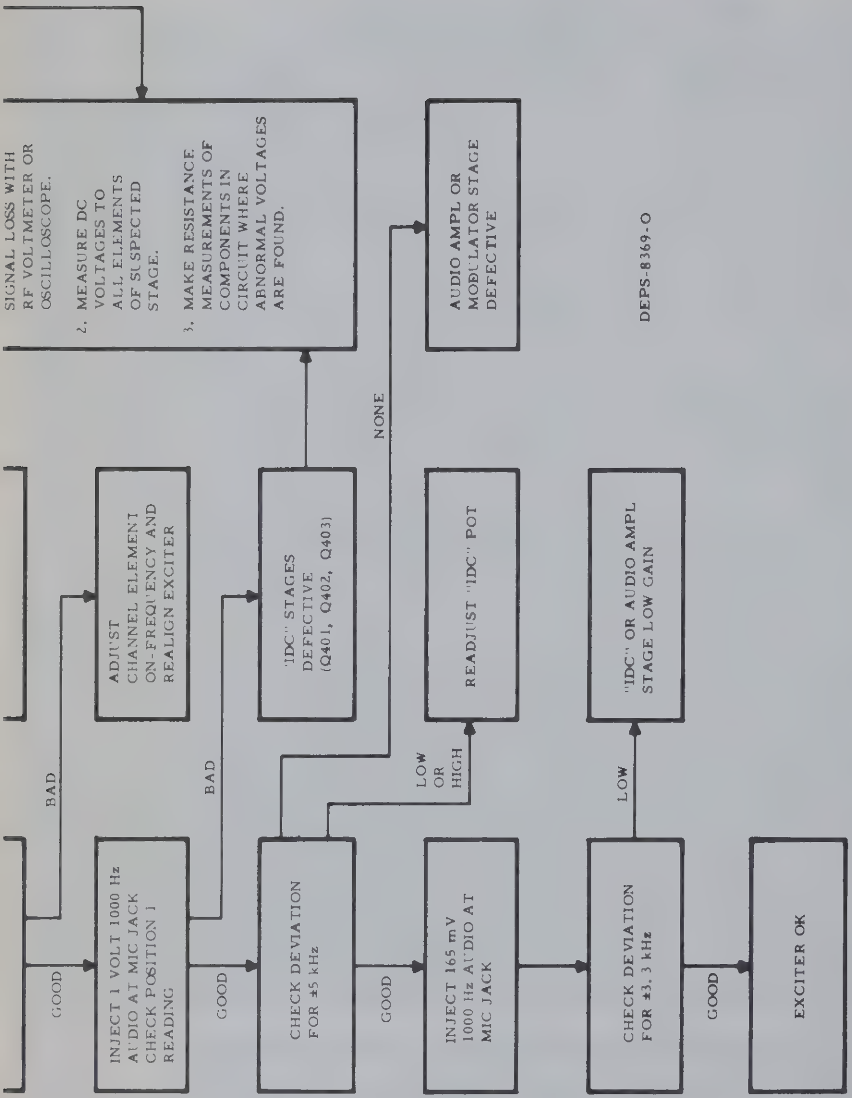
2. Set the audio oscillator to 1000 Hz and 1 volt. On tone *Private-Line* models, replace the *Vibrasender* resonant reed. On *Digital Private-Line* models, remove the short from the code disable pins.

3. Key the transmitter and adjust the IDC control for ± 5 kHz deviation.

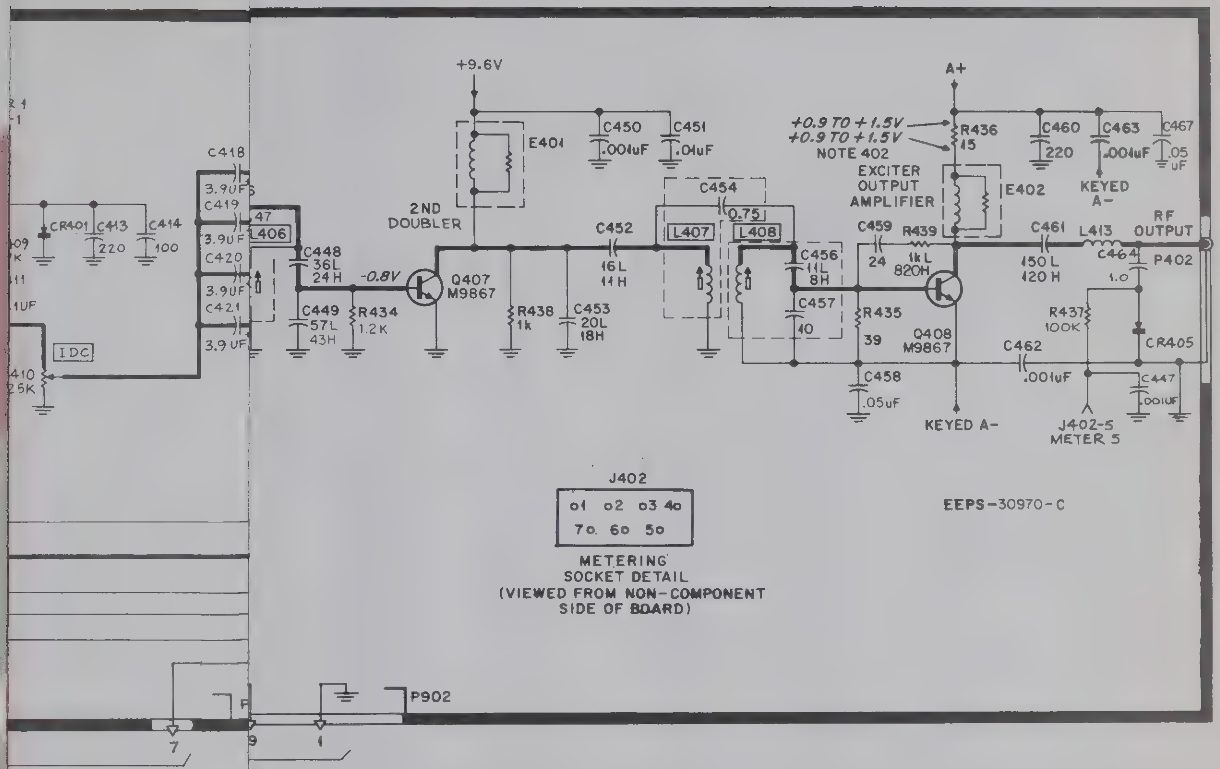
4. Reduce the tone oscillator output to .25 volt. Essentially full deviation should still be indicated. Less than full deviation may indicate a weak audio stage.

Exciter Alignment Procedure
and Troubleshooting Chart
Motorola No. ***PEPS-35502-O***
12/1/82-UP

G CHART


SIGNAL LOSS WITH RF VOLTMETER OR OSCILLOSCOPE.
2. MEASURE DC VOLTAGES TO ALL ELEMENTS OF SUSPECTED STAGE.
3. MAKE RESISTANCE MEASUREMENTS OF COMPONENTS IN CIRCUIT WHERE ABNORMAL VOLTAGES ARE FOUND.
AUDIO AMPL OR MODULATOR STAGE DEFECTIVE
NONE
ADJUST CHANNEL ELEMENT ON-FREQUENCY AND REALIGN EXCITER
"IDC" STAGES DEFECTIVE (Q401, Q402, Q403)
READJUST "IDC" POT
"IDC" OR AUDIO AMPL STAGE LOW GAIN
BAD
BAD
LOW OR HIGH
LOW
GOOD
INJECT 1 VOLT 1000 Hz AUDIO AT MIC JACK CHECK POSITION 1 READING
GOOD
CHECK DEVIATION FOR ±5 kHz
GOOD
INJECT 165 mV 1000 Hz AUDIO AT MIC JACK
CHECK DEVIATION FOR ±3.3 kHz
GOOD
EXCITER OK

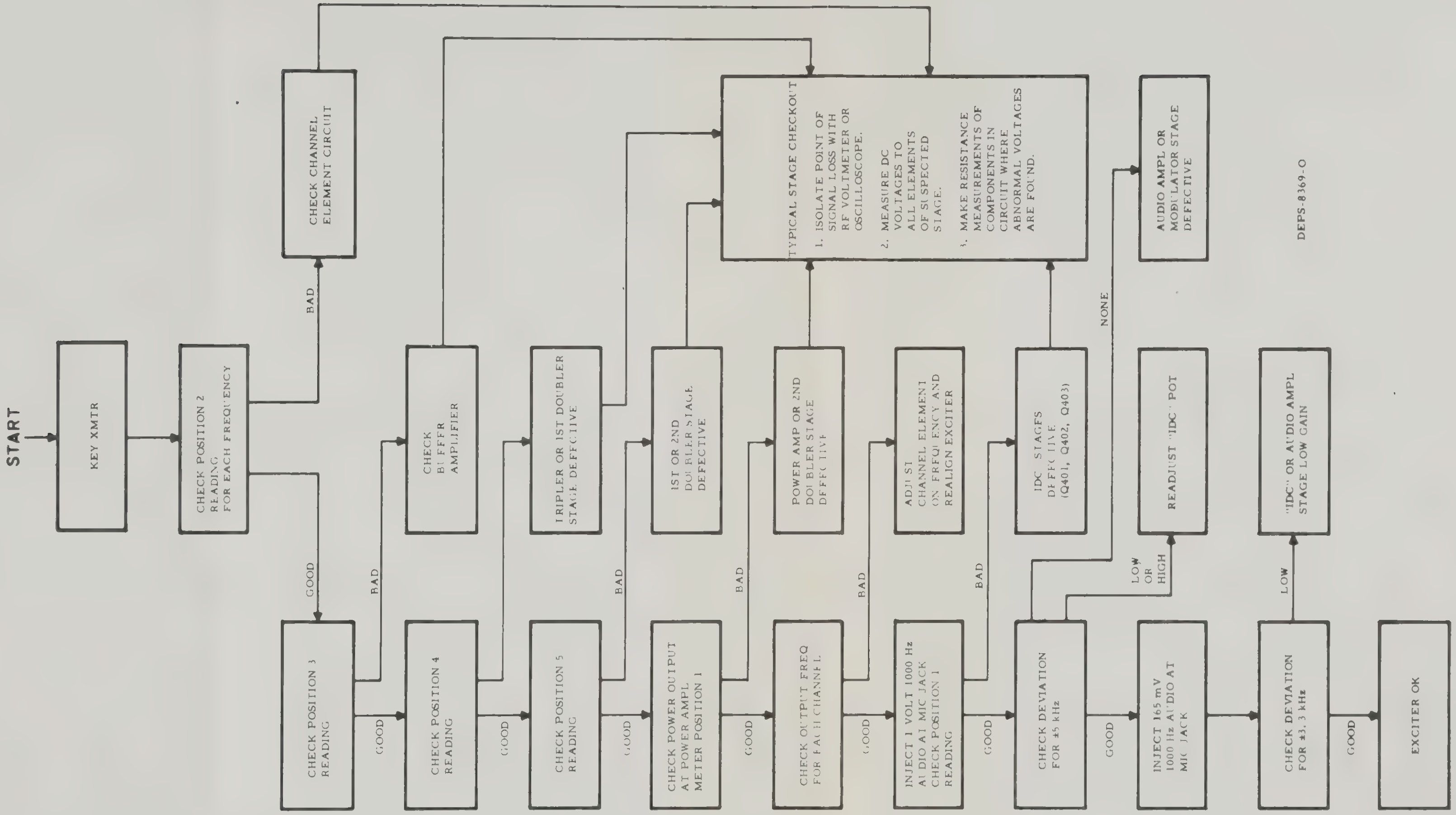
DEPS-8369-O

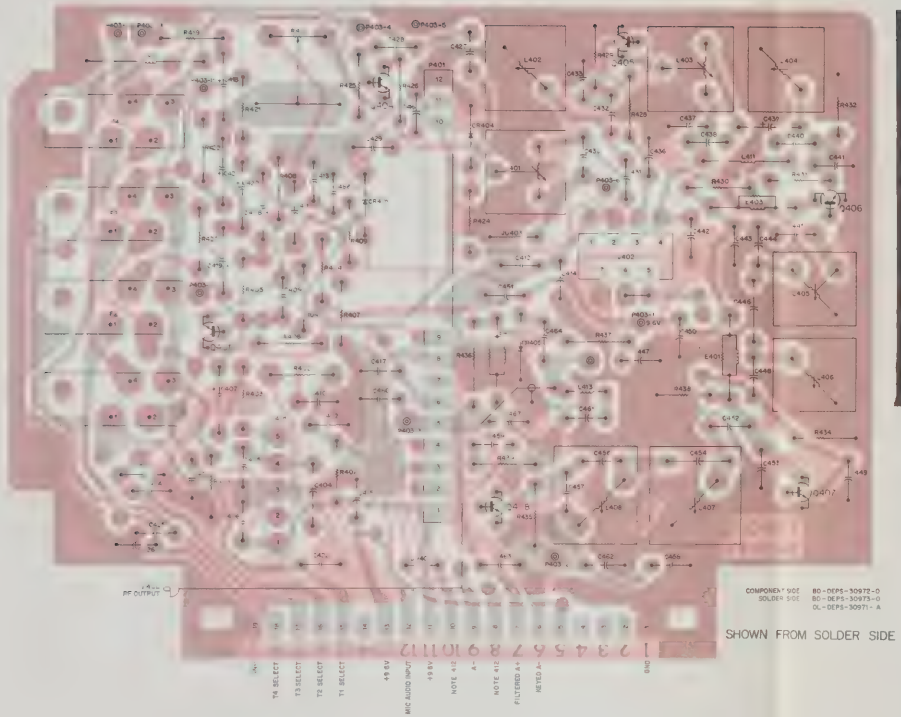

+9.6V
C450 .001uF
C451 .01uF
E401
2ND DOUBLER
C418 3.9UF
C419 47 3.9UF
L406
C420 3.9UF
C421 3.9UF
CR401
C413 220
C414 100
IDC
410 25K
C448 36L 24H
-0.8V
Q407 M9867
C449 57L 43H
R434 1.2K
R438 1k
C453 20L 18H
C452 16L 11H
C454 0.75
L407
L408
C456 11L 8H
C457 10
A+
+0.9 TO +1.5V
+0.9 TO +1.5V
NOTE 402
R436 15
EXCITER OUTPUT AMPLIFIER
E402
C460 220
C463 .001uF
C467 .05 uF
KEYED A-
RF OUTPUT
C459 24
R439 1kL 820H
C461 150L 120H
L413
C464 1.0
P402
R435 39
Q408 M9867
R437 100K
CR405
C462 .001uF
C458 .05uF
C447 .001UF
KEYED A-
J402-5 METER 5
J402
o1 o2 o3 4o
7o 6o 5o
METERING SOCKET DETAIL (VIEWED FROM NON-COMPONENT SIDE OF BOARD)
EEPS-30970-C
P902
7
9
1

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

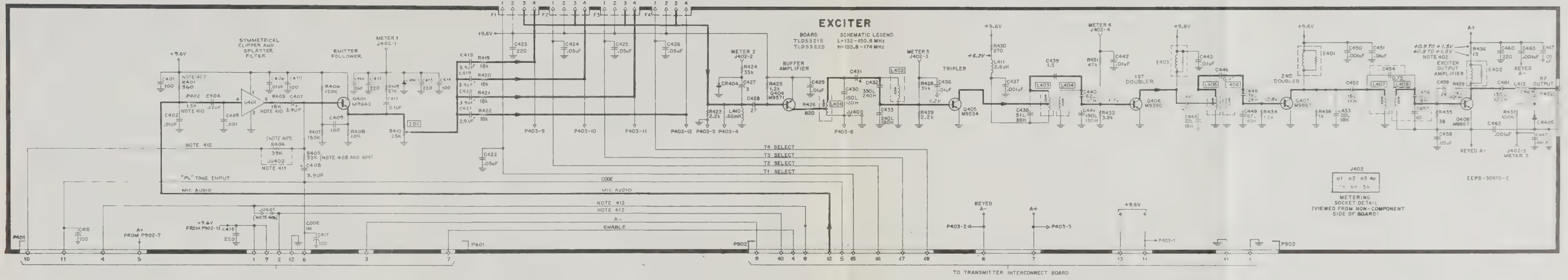
TLD5321B and TLD5322B Exciters
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-30974-B
12/1/82- UP

EXCITER TROUBLESHOOTING CHART


START
KEY XMTR
CHECK POSITION 2 READING FOR EACH FREQUENCY
BAD
CHECK CHANNEL ELEMENT CIRCUIT
GOOD
CHECK POSITION 3 READING
BAD
CHECK BUFFER AMPLIFIER
GOOD
CHECK POSITION 4 READING
TRIPLER OR 1ST DOUBLER STAGE DEFECTIVE
GOOD
CHECK POSITION 5 READING
BAD
1ST OR 2ND DOUBLER STAGE DEFECTIVE
GOOD
CHECK POWER OUTPUT AT POWER AMPL METER POSITION 1
BAD
POWER AMP OR 2ND DOUBLER STAGE DEFECTIVE
GOOD
CHECK OUTPUT FREQ FOR EACH CHANNEL
BAD
ADJUST CHANNEL ELEMENT ON FREQUENCY AND REALIGN EXCITER
GOOD
INJECT 1 VOLT 1000 Hz AUDIO AT MIC JACK CHECK POSITION 1 READING
BAD
IDC STAGES DEFECTIVE (Q401, Q402, Q403)
GOOD
CHECK DEVIATION FOR ±5 kHz
NONE
AUDIO AMPL OR MODULATOR STAGE DEFECTIVE
LOW OR HIGH
READJUST "IDC" POT
GOOD
INJECT 165 mV 1000 Hz AUDIO AT MIC JACK
CHECK DEVIATION FOR ±3.3 kHz
LOW
"IDC" OR AUDIO AMPL STAGE LOW GAIN
GOOD
EXCITER OK
TYPICAL STAGE CHECKOUT
1. ISOLATE POINT OF SIGNAL LOSS WITH RF VOLTMETER OR OSCILLOSCOPE.
2. MEASURE DC VOLTAGES TO ALL ELEMENTS OF SUSPECTED STAGE.
3. MAKE RESISTANCE MEASUREMENTS OF COMPONENTS IN CIRCUIT WHERE ABNORMAL VOLTAGES ARE FOUND.
DEPS-8369-O


RF OUTPUT
COMPONENT SIDE BD-DEPS-30972-O
SOLDER SIDE BD-DEPS-30973-O
OL-DEPS-30971-A
T4 SELECT
T3 SELECT
T2 SELECT
T1 SELECT
+9.6V
MIC AUDIO INPUT
+9.6V
NOTE 412
A-
NOTE 412
FILTERED A+
KEYED A-
GND

SHOWN FROM SOLDER SIDE


EXCITER
BOARD
TLD5321B
TLD5322B
SCHEMATIC LEGEND
L=132-150.8 MHz
H=150.8-174 MHz
SYMMETRICAL CLIPPER AND SPLATTER FILTER
EMITTER FOLLOWER
METER 1 J402-1
METER 2 J402-2
BUFFER AMPLIFIER
METER 3 J402-3
TRIPLER
METER 4 J402-4
1ST DOUBLER
2ND DOUBLER
EXCITER OUTPUT AMPLIFIER
RF OUTPUT
KEYED A-
J402-5 METER 5
"PL" TONE INPUT
MIC AUDIO
CODE
NOTE 412
A-
ENABLE
T4 SELECT
T3 SELECT
T2 SELECT
T1 SELECT
J402
METERING SOCKET DETAIL (VIEWED FROM NON-COMPONENT SIDE OF BOARD)
EEPS-30970-C
TO TRANSMITTER INTERCONNECT BOARD

NOTES

401 Transmitter Frequency Calculation:

$$f_o = \frac{f_c}{12} \qquad f_c = f_o\,12$$

Where
fo = Channel Element Frequency
fc = Carrier Frequency

402 Voltage measured across R436

403. High impedance transistorized voltmeters (11 megohm) not recommended.

404. Unless otherwise stated, voltages measured in respect to chassis ground.

405. Unless otherwise stated, capacitor values are in picofarads.

406. JU401 removed in *Private-Line* and *PURC* paging radios.

407 R401 removed in remote control stations.

408. R405 is removed unless code inputs are applied via P401-6 or P902-5.

409. R404 and R405 are factory selected so that *Private-Line* deviation falls between 500 Hz and 1000 Hz limits.

410. R402 and R403 removed only in flat audio stations.

411. JU402 is added when flat audio board is used.

412.

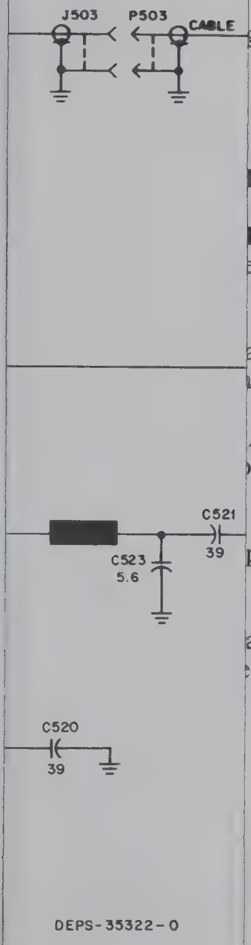
With PL Squelch Signal Name	With Flat Audio Option Signal Name
P401-10 Code Input	IDC Limited Flat Audio
P401-4, 902-8 Delayed Keyed A +	Flat Audio
P401-2, 902-10 Keyed A +	Flat Audio Control

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLD5321B and TLD5322B Exciters
Schematic Diagram and Circuit Board Detail
Motorola No. ***PEPS-30974-B***
12/1/82-UP

TRIPLER/DOUBLER AMPLIFIER

MODEL TLF1202A



greater, the tripler/doubler
all rf cable connectors and

AMPLIFIER REMOVAL
ION PROCEDURE

TE
ed from the front of

aptivated power amplifier
heat sink.

A assembly up and off the
usly disconnect the follow-

ptacle on transmitter inter-

amplifier output receptacle
er.

- IPA output plug from antenna network.

The PA assembly is now completely disconnected from the unified chassis and can be placed to one side.

Step 3. Loosen the three captive screws used to mount the IPA mounting bracket and remove the bracket.

Step 4. Disconnect the plug connected to TRPLR receptacle on the transmitter interconnect board.

Step 5. Loosen the four captivated screws that hold the tripler/low-level amplifier in place.

Step 6. Carefully pull out the tripler/low-level amplifier part way and then disconnect the plug connected to the output of the first bandpass filter. The tripler/doubler amplifier is now completely disconnected.

Step 7. To reinstall the tripler/doubler amplifier, reverse the procedure in Steps 1 to 6.

PARTS LIST SHOWN ON BACK OF THIS PAGE

parts list

TLD5321B Exciter (132-150.8 MHz) = L
TLD5322B Exciter (150.8-174 MHz) = H

PL-7116-A

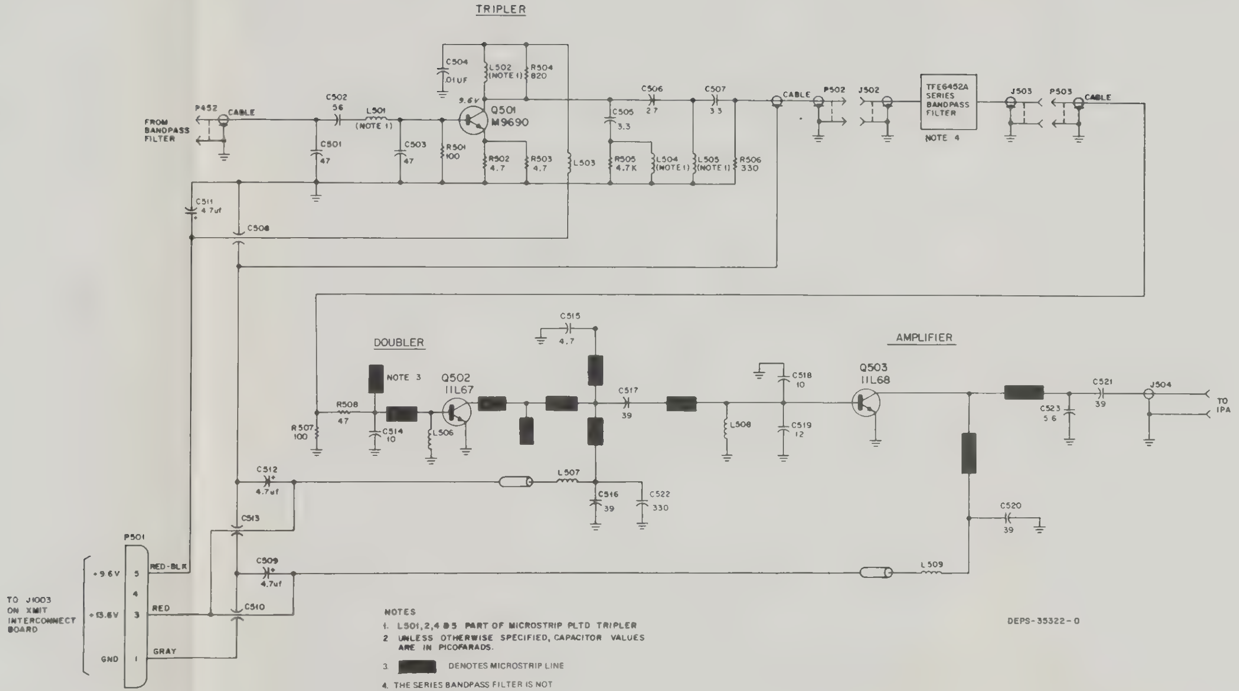
This parts list covers two models of the high band Exciter Board. Where differences exist a letter suffix L or H is added to the reference symbol to show the applicable unit.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 5%; 500 V unless otherwise stated
C401	21-831125	100 ± 10%; 300 V
C402	21-83596E21	.01 uF + 80-20%; 200 V
C403		NOT USED
C404	8-82905G11	.22 uF ± 10%; 50 V
C405	21-83596E13	.001 uF ± 10%; 100 V
C406	21-83596E21	.01 uF + 80-20%; 200 V
C407, 408	23-84762H08	3.9 uF ± 20%; 15 V
C409, 410	21-831125	100 ± 10%; 300 V
C411	21-82372C03	0.1 uF + 80-20%; 25 V
C412, 413, 415	21-83596E10	220 ± 20%
C414, 416, 417	21-831125	100 ± 10%; 300 V
C418 thru 421	23-84762H08	3.9 uF ± 20%; 15 V
C422	21-82372C10	.05 uF + 80-20%; 25 V
C423	21-83596E10	220 ± 10%
C424, 425, 426	21-82872C10	.05 uF + 80-20%; 25 V
C427	21-83406D51	3 ± 0.25 pF
C428	21-83406D68	27; 500 V
C429	21-83596E21	.01 uF + 80-20%; 200 V
C430L	21-84494B07	150
C430H	21-84494B06	120
C431	21-83406D54	4 ± 0.25 pF
C432L	21-84494B16	330
C432H	21-84494B13	240
C433L	21-84494B13	240
C433H	21-84494B46	180 ± 3%
C434, 435		NOT USED
C436	21-83596E21	.01 uF + 80-20%; 200 V
C437	21-83596E13	.001 uF ± 10%; 100 V
C438L	21-84494B01	51
C438H	21-84494B24	39
C439	21-861453	1.5 ± 10%
C440L	21-852322	62
C440H	21-868681	47
C441L	21-84494B10	190
C441H	21-861601	130
C442, 443	21-83596E21	.01 uF + 80-20%; 200 V
C444L	21-84493B26	22
C444H	21-83406D55	18
C445	21-82187B45	470 ± 10%
C446	21-82450B37	0.47
C447	21-83596E13	.001 uF ± 10%; 100 V
C448L	21-83406D92	36
C448H	21-83406D56	24
C449L	21-84493B31	57; 200 V
C449H	21-84494B28	43
C450	21-83596E13	.001 uF ± 10%; 100 V
C451	21-83596E21	.01 uF + 80-20%; 200 V
C452L	21-83406D93	16
C452H	21-83406D90	11
C453L	21-83406D81	20
C453H	21-83406D55	18
C454	21-82450B06	0.75 ± 10%
C455		NOT USED
C456L	21-83406D90	11
C456H	21-83406D70	8 ± 0.5 pF
C457	21-83406D89	10 ± 0.5 pF
C458	21-82372C10	.05 ± 20%; 25 V
C459	21-840365	24; NP0
C460	21-83596E10	220 ± 20%
C461L	21-84494B07	150
C461H	21-84494B06	120
C462, 463	21-83596E13	.001 uF ± 10%; 100 V
C464	21-82355B62	1.0
C465		NOT USED
C466	21-82187B06	560
C467	21-82372C10	.05 ± 20%; 25 V
		diode: (see note)
CR401	48-863030	germanium
CR402, 403		NOT USED
CR404, 405	48-82139G01	germanium
		coil, rf:
E401	24-84392B06	40 turns on 820 ohm resistor
E402L	24-84392B13	15 turns on 560 ohm resistor
E402H	24-84392B05	9 turns on 560 ohm resistor
E403L	24-84392G18	40 turns on 10k ohm resistor
E403H	24-82835G08	2.7 uH coded RED-BLU-GLD
		connector, receptacle:
J401		NOT USED
J402	9-84207B01	7 contacts
		coil, rf:
L401	24-84389B02	18-2/3 turns; coded BLK
L402	24-84389B01	18-1/2 turns; coded YEL
L403	24-84389B06	8-2/3 turns; coded GRN
L404	24-84389B05	8-1/2 turns; coded RED
L405	24-84972A33	6-1/2 turns; coded RED
L406	24-84972A09	6-1/2 turns; coded YEL
L407, 408	24-84972A11	3-1/2 turns; coded GRN
L409		NOT USED
L410	24-80900A61	0.62 mH
L411	24-82835G08	2.6 uH; coded RED-BLU-GLD
L412		NOT USED
L413H	24-84923C01	1-1/2 turns
L413L	24-84923C04	2-1/2 turns
		connector, plug:
P401		part of printed circuit board
P402	28-84282D01	phono
P403, 902		part of printed circuit board
		transistor: (see note)
Q401	48-869642	NPN; type M9642
Q402, 403		NOT USED
Q404	48-869571	PNP; type M9571
Q405	48-869534	NPN; type M9534
Q406	48-869390	NPN; type M9390
Q407, 408	48-869867	NPN; type M9867
		resistor, fixed: ± 5%; 1/4 W unless otherwise stated
R401	6-124A43	560
R402	6-124A53	1.5k
R403	6-124A79	18k
R404	6-124A87 or 6-124A89	39k 47k (factory selected for DPL models only)
R405	6-124A85 or 6-124A89	33k 47k (factory selected for PL models only)
R406	6-124A99	120k
R407	6-124B04	180k
R408	6-124A73	10k
R409	6-124A83	27k
R410	18-83083G24	variable: 25k ± 30%
R411 thru 418		NOT USED
R419	6-124A79	18k%
R423	6-124A57	2.2k
R424	6-124A85	33k
R425	6-124A51	1.2k
R426	6-124A47	820
R427		NOT USED
R428	6-124A87	39k
R429	6-124A57	2.2k
R430	6-124A35	270
R431	6-124A89	47k
R432	6-124A63	3.9k
R433		NOT USED
R434	6-124A51	1.2k
R435	6-124A15	39
R436	6-125C05	15 ± 10%; 1/2 W
R437	6-124A97	100k
R438	6-124A49	1k
R439L	6-124A49	1k
R439H	6-124A47	820
		symmetrical clipper and splatter filter:
U401	1-80726D74	potted unit
		non-referenced items
	14-861196	INSULATOR, transistor; 2 req'd. (used with Q407 & Q408)
	26-83379H01	HEAT SINK (used with Q408)
	26-84598A01	SHIELD, coil; 2 req'd. (used with L405, L406)
	26-84598A02	SHIELD, coil; 4 req'd. (used with L401 thru L404)
	26-84250B14	SHIELD, coil; 2 re'd. (used with L407, L408)
	42-84284B01	RETAINER: 4 req'd.
	3-139506	HEX LOCK; 4-40 x 5/8"; 4 req'd. (used for mounting Retainers)
	55-84300B01	HANDLE
	30-83794C01	CABLE, coaxial; 6" req'd. (used with P402)
	29-84028H01	TERMINAL, pin; 19 req'd.
	29-84028H02	TERMINAL, pin; 12 req'd.
	29-855943	TERMINAL, pin; 16 req'd.
	39-10184A10	CONTACT, terminal; 10 req'd.

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRIPLER/DOUBLER AMPLIFIER

MODEL TLF1202A



NOTES

1. L501,2,4 & 5 PART OF MICROSTRIP PLTD TRIPLER
2. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS.
3. ■ DENOTES MICROSTRIP LINE
4. THE SERIES BANDPASS FILTER IS NOT REPAIRABLE IF DEFECTEVE IT MUST BE REPLACED IN ITS ENTIRITY

1. DESCRIPTION

1.1 The function of the TLF1202A Tripler/Doubler Amplifier is to provide a ×6 multiplication factor of the exciter frequency, and to amplify the signal to a sufficient level to drive the intermediate power amplifier (IPA).

1.2 The tripler and doubler amplifier circuitry are located on two aluminum substrates. The tripler circuitry occupies a single substrate and the doubler amplifier shares a second substrate. The two substrates are housed in the chassis and hardware kit, and are interfaced with each other by the bandpass filter.

Model Complement

Model	Description
TFE6452A	Bandpass Filter
TLF6412A	Tripler/Doubler Amplifier
TRN5161A	Chassis & Hardware Kit

2. THEORY OF OPERATION

The exciter generates an rf signal in the 154.6-160 MHz range. This signal is applied to the first bandpass filter. The purpose of the first bandpass filter is to attenuate all spurious signals outside the 154.6-160 MHz frequency range. The output of the bandpass filter is routed via a coaxial cable to the tripler input Q501. The minimum signal level to the tripler input is 400 mW. The tripler circuit provides a ×3 frequency multiplication factor. The output frequency range of the tripler is 464-480 MHz. The tripler output is applied to the TFE6452A Bandpass Filter. The function of the bandpass filter is to pass signals only in the 464-480 MHz frequency range. The output of the bandpass filter is applied to the doubler amplifier input Q502. The minimum power level at the doubler amplifier input is 175 mW. The doubler amplifier provides a ×2 frequency multiplication such that the output frequency range is 928-960 MHz, a signal level of 300 mW. This signal is applied to the amplifier stage Q503 via the microstrip medium. Q503 provides signal amplification in the 928-960 MHz frequency range. The minimum signal level at the amplifier output is 1 watt. The amplifier output is interfaced with the IPA input via a coaxial cable transmission line.

3. TRIPLER/DOUBLER AMPLIFIER MAINTENANCE

NOTE

> Field servicing of the tripler/doubler amplifier should not be attempted. If the tripler/doubler amplifier is defective, replace the entire unit. Removal and replacement is described following performance testing.

3.1 PERFORMANCE TESTS

Step 1. Be sure the transmitter is not keyed. Turn the Drive Limit control fully counterclockwise (minimum drive limit).

Step 2. Check all PA transistors except for those in the controlled stage for proper collector operating voltages (+13.6 volts). The controlled stage collector voltage cannot be checked until later in this procedure.

Step 3. Turn the POWER SET control fully counterclockwise (minimum power output).

Step 4. Connect a 900 MHz wattmeter to the transmitter output connector with an 8-inch or shorter length of coaxial cable. The wattmeter must be terminated in a 50-ohm resistive dummy load.

Step 5. Disconnect the transmitter output coax cable connector from the antenna network.

Step 6. Disconnect the rf connector from the output jack on the tripler/doubler amplifier. Connect the tripler/doubler amplifier output to the antenna network input using a short BNC-to-BNC adapter cable.

Step 7. Key the transmitter and check the tripler/doubler amplifier output. The wattmeter reading should be at least 1.0 watt.

Step 8. If the tripler/doubler amplifier power output is low, check exciter meter position 5. With the REF switch on the TEK-37A test set adapter cable set to B, the meter 5 reading should be at least 15 uA. If the meter 5 reading is low, the exciter is defective. If the meter 5 reading is 15 uA or greater, the tripler/doubler amplifier is bad. Also check all rf cable connectors and the bandpass filter.

3.2 TRIPLER/DOUBLER AMPLIFIER REMOVAL AND REINSTALLATION PROCEDURE

NOTE

> All steps are performed from the front of the station.

Step 1. Loosen the two captivated power amplifier assembly screws on the IPA heat sink.

Step 2. Pivot and lift the PA assembly up and off the pivot bushing and simultaneously disconnect the following connectors.

- power plug from IPA receptacle on transmitter interconnect board.
- tripler plug from low level amplifier output receptacle on tripler/doubler amplifier.
- IPA output plug from antenna network.

The PA assembly is now completely disconnected from the unified chassis and can be placed to one side.

Step 3. Loosen the three captive screws used to mount the IPA mounting bracket and remove the bracket.

Step 4. Disconnect the plug connected to TRPLR receptacle on the transmitter interconnect board.

Step 5. Loosen the four captivated screws that hold the tripler/low-level amplifier in place.

Step 6. Carefully pull out the tripler/low-level amplifier part way and then disconnect the plug connected to the output of the first bandpass filter. The tripler/doubler amplifier is now completely disconnected.

Step 7. To reinstall the tripler/doubler amplifier, reverse the procedure in Steps 1 to 6.

PARTS LIST SHOWN ON BACK OF THIS PAGE

MOTOROLA INC.
Communications
Sector

INTERMEDIATE POWER AMPLIFIER

MODEL TLF1212A

TLF1212A Intermediate Power Amplifier Model Complement

Model	Description
TRN4847A	Heat Sink and Hardware Kit
TLF6422A	Input Amplifier
TLF6432A	Pre-driver Amplifier
TLF6442A	Driver Amplifier
TLF6452A	Final Amplifier
TLN2560A	Cable & Bracket IPA

1. TLF1212A INTERMEDIATE POWER AMPLIFIER FUNCTIONAL OPERATION

The TLF1212A Intermediate Power Amplifier (IPA) is a four stage unit consisting of two control stages, a driver stage, and a final stage. The gain of the IPA is controlled by the power control board via the directional coupler. Output signals are sampled by the power control board, which reduces or increases the drive to IPA driver stages Q601 and Q602. The IPA is protected against overdriving and high VSWR by the power control board. The output of the IPA (approximately 14 watts) is applied through a directional coupler to the 125-watt power amplifier.

2. IPA POWER SETTING PROCEDURE

NOTE

If the transmitter is to be brought back up to rated power after turning down the POWER SET control for alignment or troubleshooting procedure, proceed directly to Step 4.

Alignment Procedure

Step	Adjust	Metering Plug Location	Test Set Selector Switch Position	Meter Rev. Switch and Ref A-B Switch	Stage and Procedure
1	Power Set and Drive	Power Control Board	Wattmeter		Pre-setting of Controls: Adjust the drive limit control fully counterclockwise (maximum drive). Adjust the Power Set Control fully clockwise (near maximum power output). Connect a wattmeter and load to the directional coupler rf output connector and remove the shield from over the power control board.
2	Drive Limit	Power Control Board	Wattmeter		Key Transmitter. Adjust drive limit (R609 on power control board) until a power output of 20 watts is obtained. If the maximum power output is between 17 and 20 watts, set the drive limit wide open. On multi-frequency radios, check drive limit on both channels. If necessary, readjust Drive Limit control so the lowest power channel is set to 20 watts. If the Drive Limit control cannot obtain a high enough reading, set it fully counterclockwise (minimum drive limit). Unkey the transmitter and replace shield.
3	Power Set	Power Control	Wattmeter		Key the transmitter. Adjust the power set control (R607 on power control board) until power output is within the station licensing parameters (see Figures 1 & 2). On multifrequency radios, check power output on all channels. If necessary, readjust Power Set so the lowest power channel is set per Figures 1 & 2. Unkey transmitter. This completes the IPA power setting procedure.

parts list

TRN5161A Chassis and Hardware Kit PL-8210-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C508, 510, 513	91-87511C01	RFI, filter
		connector, receptacle:
J504	9-84968D01	bulkhead jack
		connector, plug:
P452	28-84282D01	phono, male
P501	—	consists of:
	15-83498F05	HOUSING, plug: 5-position
	29-83499F01	TERMINAL; 3 used
	46-84549F01	PLUG, polarizing
P502, 503	28-84282D01	phono, male
	mechanical parts	
	1-80754D25	COVER, triple/doubler
	3-135102	SCREW, tapping: 4-40 x 1/4"; 2 used
	3-138162	SCREW, tapping: 4-40 x 3/8"; 2 used
	30-84252K01	CABLE, shielded; 1.81" used
	30-83794C01	CABLE, coaxial: 2.16" used
	42-10217A02	STRAP, tie
	42-84284B02	RETAINER; 4 used

TFE6452A Bandpass Filter PL-8163-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		coil, rf:
L2, L3	24-84288C07	3 11/16 turns
L1, L4	24-84288C18	3 3/4 turns
	mechanical parts	
	3-1438	SCREW, machine; 2-56 × 3/16; 2 req'd.
	3-7164	SCREW, machine; 6-32 × 1/4"; 4 req'd.
	3-134186	SCREW, tapping; 6-32 × 5/16"; 2 req'd.
	3-84347C01	SCREW, set; 4 req'd.
	4-852094	WASHER, insulator; 4 req'd.
	15-84246C01	HOUSING, filter box
	15-84286C01	COVER, top; filter box
	15-84289C03	COVER, bottom
	74-84287C01	FORM, coil; 4 req'd.

TLF6412A Tripler and Doubler PL-8211-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF; 50 V: unless otherwise stated
C501	21-84873H45	47 + 5%
C502	21-84873H17	56 + 10%
C503	21-84873H45	47 + 5%
C504	21-84547A05	.01 uF ± 10%
C505	21-84736E27	3.3 ± .25 pF
C506	21-84736E26	2.7 + .25 pF
C507	21-84736E27	3.3 ± .25 pF
C509, 512	23-82783B25	4.7 uF ± 10%; 25 V
C514	21-84736E16	10 ± 5 pF
C515	21-84736E28	4.7 ± .25 pF
C516, 517	21-84873H63	39 ± 5%
C518	21-84736E16	10 ± 0.5 pF
C519	21-84736E15	12 ± 5%
C520, 521	21-84873H63	39 ± 5%
C522	21-84873H98	330 ± 10%
C523	21-84736E18	5.6 ± .25 pF
		coil, rf:
L501, 502	—	non-replaceable part
L503	24-82000E25	4-turns; coded BLU
L504, 505	—	non-replaceable part
L506	24-82723H04	0.29 uH
L507	24-82000E25	4-turns; coded BLU
L508	24-80202B01	3-turns with bead
L509	24-82000E25	4-turns; coded BLU
		resistor, fixed: ± 10%; 1/8 W: unless otherwise stated
R501	6-185B67	100
R502, 503	6-125B61	4.7 ± 5%; 1/2 W
R504	6-185B79	1k
R505	6-185B87	4.7k
R506	6-185B73	330
R507	6-185B67	100
R508	6-185B63	47
		transistor: (see note)
Q501	48-869690	NPN; type M9690
Q502	48-84411L67	NPN; type M1167
Q503	48-84411L68	NPN; type M1168
	mechanical parts	
	2-84628A01	NUT, transistor mounting; 3 used
	3-7467	SCREW, tapping; 8-18 x 3/8"; 2 used
	14-83528M01	INSULATOR, right half
	14-83529M01	INSULATOR, left half
	76-83960B01	CORE, ferrite
	76-84069B01	CORE, ferrite bead; 2 used

MOTOROLA INC.
Communications
Sector

INTERMEDIATE POWER AMPLIFIER

MODEL TLF1212A

TLF1212A Intermediate Power Amplifier Model Complement

Model	Description
TRN4847A	Heat Sink and Hardware Kit
TLF6422A	Input Amplifier
TLF6432A	Pre-driver Amplifier
TLF6442A	Driver Amplifier
TLF6452A	Final Amplifier
TLN2560A	Cable & Bracket IPA

1. TLF1212A INTERMEDIATE POWER AMPLIFIER FUNCTIONAL OPERATION

The TLF1212A Intermediate Power Amplifier (IPA) is a four stage unit consisting of two control stages, a driver stage, and a final stage. The gain of the IPA is controlled by the power control board via the directional coupler. Output signals are sampled by the power control board, which reduces or increases the drive to IPA driver stages Q601 and Q602. The IPA is protected against overdriving and high VSWR by the power control board. The output of the IPA (approximately 14 watts) is applied through a directional coupler to the 125-watt power amplifier.

2. IPA POWER SETTING PROCEDURE

NOTE

If the transmitter is to be brought back up to rated power after turning down the POWER SET control for alignment or troubleshooting procedure, proceed directly to Step 4.

Alignment Procedure

Step	Adjust	Metering Plug Location	Test Set Selector Switch Position	Meter Rev. Switch and Ref A-B Switch	Stage and Procedure
1	Power Set and Drive	Power Control Board	Wattmeter		Pre-setting of Controls: Adjust the drive limit control fully counterclockwise (maximum drive). Adjust the Power Set Control fully clockwise (near maximum power output). Connect a wattmeter and load to the directional coupler rf output connector and remove the shield from over the power control board.
2	Drive Limit	Power Control Board	Wattmeter		Key Transmitter. Adjust drive limit (R609 on power control board) until a power output of 20 watts is obtained. If the maximum power output is between 17 and 20 watts, set the drive limit wide open. On multi-frequency radios, check drive limit on both channels. If necessary, readjust Drive Limit control so the lowest power channel is set to 20 watts. If the Drive Limit control cannot obtain a high enough reading, set it fully counterclockwise (minimum drive limit). Unkey the transmitter and replace shield.
3	Power Set	Power Control	Wattmeter		Key the transmitter. Adjust the power set control (R607 on power control board) until power output is within the station licensing parameters (see Figures 1 & 2). On multifrequency radios, check power output on all channels. If necessary, readjust Power Set so the lowest power channel is set per Figures 1 & 2. Unkey transmitter. This completes the IPA power setting procedure.

Step	Adjust	Metering Plug Location	Test Set Selector Switch Position	Meter Rev. Switch and Ref A-B Switch	Stage and Procedure
4	Filament Voltage	P.A.	Voltmeter		Verify standby filament voltage of 6.3 V dc Key exciter — IPA and verify that filament voltage drops to 4.8 V dc. Readjust as necessary with controls located on the power supply regulator board.

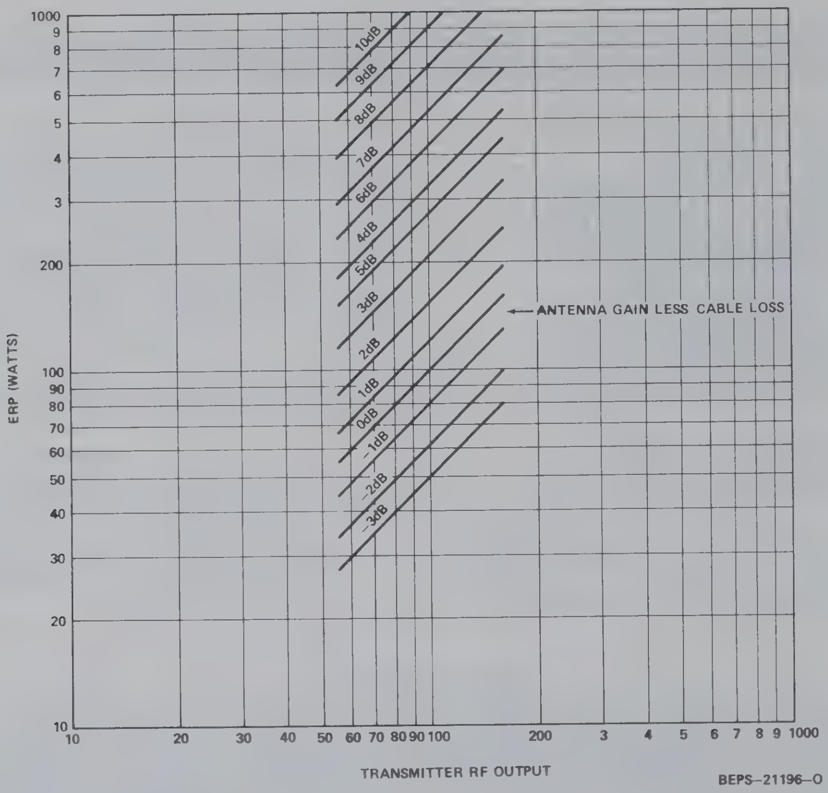


Figure 1. Effective Radiated Power

3. MAINTENANCE AND TROUBLESHOOTING

To determine if the IPA is operating properly, attach a wattmeter and a 50 ohm load to the directional coupler output.

Step 1. Key the station. Turn the power set control (R607) fully clockwise and the drive limit control (R609) fully counterclockwise (located on power control board and viewed from front of station). If power output is less than 17 watts, measure controlled A+ and A+ (blue and red wires respectively) at the IPA feedthrough terminals.

Step 2. If both of these voltages are greater than 12 volts, check input power by attaching a wattmeter and 50 ohm load to the low level amplifier output (be sure to de-key the station while the low level input amplifier is unloaded). If power is less than 1.0 watts, see sections 68P81063E19 and 68P81063E18 for tripler doubler/amplifier and exciter test procedures.

Step 3. If both controlled A+ and A+ are less than 12 volts, check fuse F1.

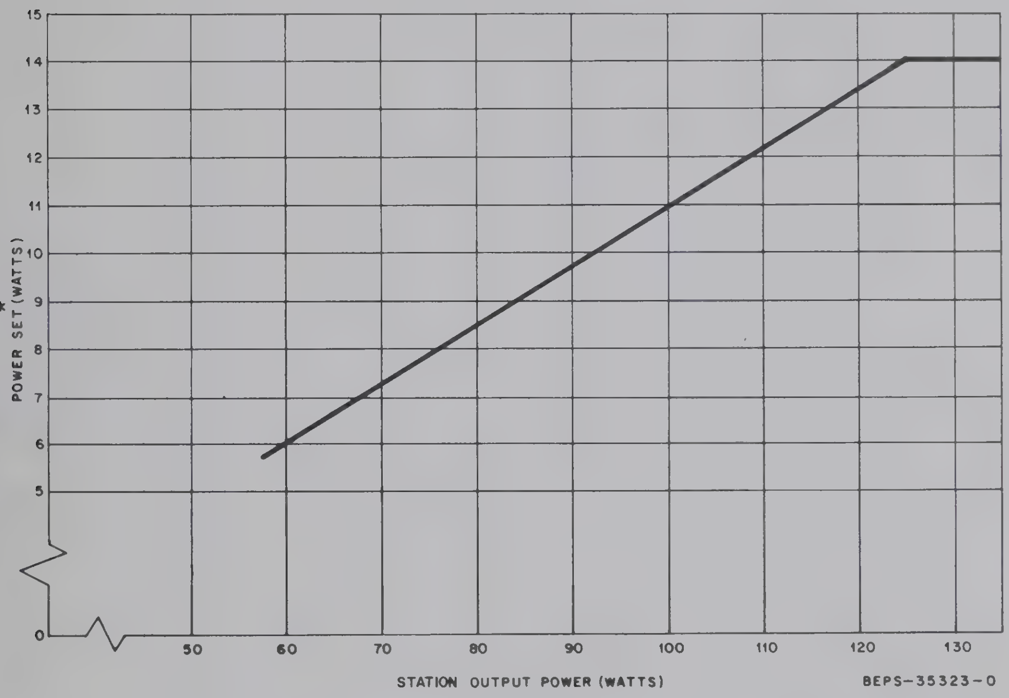
Step 4. If controlled A+ is less than 12 volts and A+ greater than 12 volts, check Q902 on the unified chassis and the power control board (section 68P81063E23).

Step 5. If Steps 1 through 4 have not isolated a malfunction, the fault is within the IPA. Insert a wattmeter between the tripler doubler/amplifier and the IPA. Key the station and measure the ratio of forward to reflected power. If this ratio is less than 3-to-1, the IPA input VSWR is too high. Check the input cables for breaks and/or shorts and the chip capacitors for signs of leaching. If chip capacitors and cables show no defects, replace the input stage (TLF6422A). If cables need replacement use kit (TKN8213A).

Step 6. If input VSWR is acceptable, turn the station off and remove the rf connecting straps between the first and second stages. Connect a cable from the output of the second control stage to a wattmeter and 50 ohm load. Turn station on. After transmitter is enabled, key the transmitter. If power out of the second stage is less than 5 watts, one or both of the first stages must be replaced.

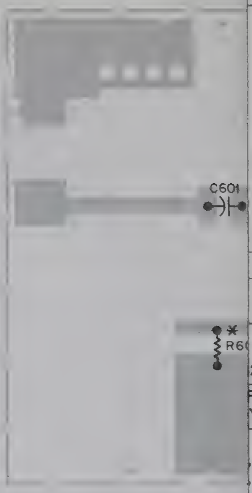
Step 7. Replace the wire removed in Step 6. Monitor the power output of the 3rd stage. If power output is less than 10 watts, replace the driver state (TLF6442A).

Step 8. Disconnect the end of the cable from the wattmeter/load and connect it to one part of a thru-line wattmeter. Connect the other end to the input circuit of the TLF6452A via a coaxial cable. Check the input VSWR of this stage as per Step 5 above.



* NOTE: POWER SET IS MEASURED AT P801 (OUTPUT CABLE OF DIRECTIONAL COUPLER)

Figure 2. IPA Power Output



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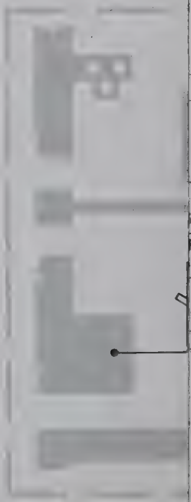

ɾts list

2A Hybrid IPA Input Amplifier

FERENCE YMBOL	MOTOROLA PART NO.	
		c
	21-84873H63	3
	21-84873H64	4.
	21-84736E12	3
	21-84547A24	0.
	21-84736E12	3
		c
	24-84331M02	3
	24-80202B03	3
		tr
	48-84411L69	N
		mech
	2-84628A01	N
	29-83208M01	L

2A Hybrid IPA Pre Driver Amplifi

FERENCE YMBOL	MOTOROLA PART NO.	
		c
, 611	21-84736E29	7.
, 613	21-84736E16	1(
	21-84547A24	.0
, 616	21-84736E12	3
	21-84736E29	7.
		c
611	24-80202B03	3
		tr
	48-84411L70	N
		mech
	42-80164B01	R
	42-80165B01	C
	42-82672N01	S
	64-84255K03	P

2A Hybrid IPA Driver Amplifier

FERENCE YMBOL	MOTOROLA PART NO.	
		c
thru 623	21-84736E15	1
, 625	21-84736E12	3
	21-84547A24	0
		c
, 621	24-80202B01	3
		t
	48-84411L71	N
		r
	6-185B55	1
		mech
	29-83208M01	L
	42-80164B01	R
	42-80165B01	C
	42-82672N01	S

2A Hybrid IPA Final Amplifier

FERENCE YMBOL	MOTOROLA PART NO.	
		c
, 631	21-84736E15	1
, 633	21-84736E45	1
, 635	21-84736E12	3
		c
	24-80202B02	3
, 632	24-80202B01	3
		t
	48-84411L72	N
		r
	6-185B55	1
		mech
	29-83208M01	L
	42-80164B01	R
	42-80165B01	C
	42-82672N01	S

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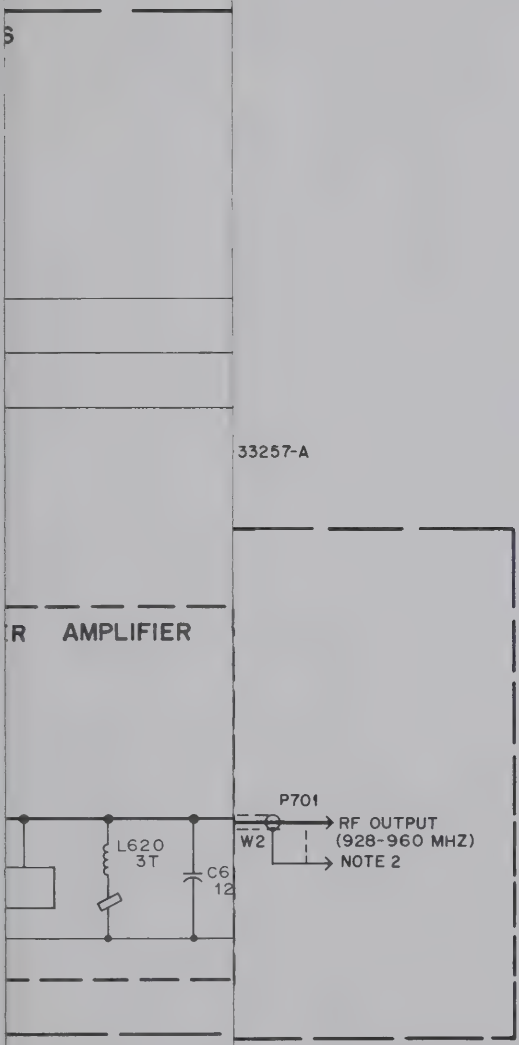
red by Motorola part numbers.

TLF1212A IPA Schematic Diagram,
Circuit Board Detail and Parts List
Motorola No. ***PEPS-35504-O***
(Sheet 1 of 2)
12/1/82-UP



NOTES:

1. Unless otherwise indicated, resistor values are in ohms and capacitor values are in picofarads.
2. IPA output power varies from 0 to greater than 14 W, depending proportionally upon the control voltage applied to the collectors of Q601 and Q602.
3. J603 used to measure Q603 and Q604 collector current, as well as collector voltage applied to Q601 and Q602. Refer to the IPA Troubleshooting Chart for normal meter readings.

TLF1212A IPA Chassis Model Complement

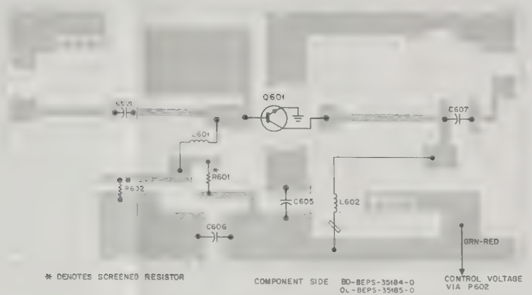
TKN8213A	IPA Cable & Metering Kit
TLF6422A	1st Controlled Amplifier Module
TLF6432A	2nd Controlled Amplifier Module
TLF6442A	Predriver Amplifier Module
TLF6452A	Driver Amplifier Module
TRN4849A	Heat Sink & Hardware Kit

NOTE

Modules are not field repairable. Order replacement by kit number, TLFXXXX.

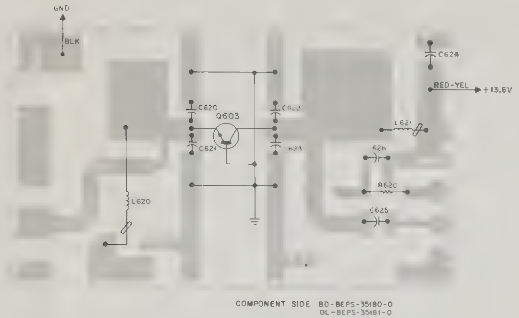
TLF1212A IPA Schematic Diagram,
Circuit Board Detail and Parts List
Motorola No. ***PEPS-35504-O***
(Sheet 2 of 2)
12/1/82- UP

TLF6422A INPUT AMPLIFIER


Q601
C607
L601
R601
R602
C605
L602
C606
GRN-RED
* DENOTES SCREENED RESISTOR
COMPONENT SIDE BD-BEPS-35184-0
OL-BEPS-35185-0
CONTROL VOLTAGE
VIA P602

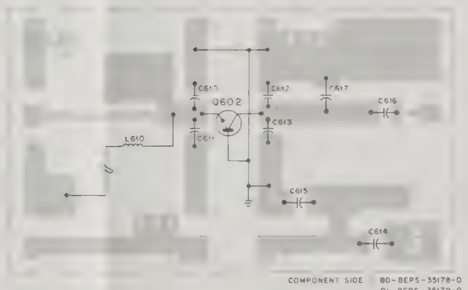
SHOWN FROM COMPONENT SIDE

TLF6442A DRIVER AMPLIFIER


GND
BLK
C624
RED-YEL
+13.6V
C620
Q603
C621
L620
L621
626
R620
C625
COMPONENT SIDE BD-BEPS-35180-0
OL-BEPS-35181-0

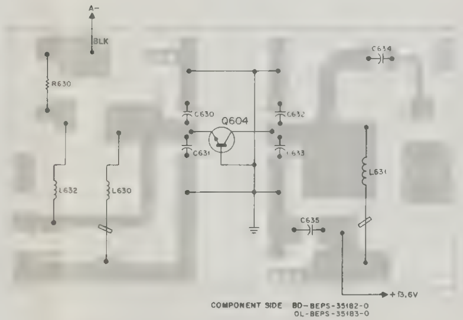
SHOWN FROM COMPONENT SIDE

TLF6432A PRE-DRIVER AMPLIFIER


Q602
C612
C613
C617
C616
L610
C615
C614
COMPONENT SIDE BD-BEPS-35178-0
OL-BEPS-35179-0

SHOWN FROM COMPONENT SIDE

TLF6452A HYBRID IPA FINAL AMPLIFIER


A-
BLK
R630
C634
C630
Q604
C632
C631
L632
L630
L631
C635
+13.6V
COMPONENT SIDE BD-BEPS-35182-0
OL-BEPS-35183-0

SHOWN FROM COMPONENT SIDE

TLF1212A IPA Schematic Diagram,
Circuit Board Detail and Parts List
Motorola No. PEPS-35504-O
(Sheet 1 of 2)

parts list

TLF6422A Hybrid IPA Input Amplifier PL-8159-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C601	21-84873H63	39 pF ± 5%; 50 V
C602	21-84873H64	4.3 pF ± .25; 50 V
C605	21-84736E12	39 pF ± 5%; 50 V
C606	21-84547A24	0.1 uF ± 20%, 25 V
C607	21-84736E12	39 pF ± 5%; 50 V
		coil, rf:
L601	24-84331M02	3 turns
L602	24-80202B03	3 turns
		transistor: (see note)
Q601	48-84411L69	NPN, type M1169
		mechanical parts
	2-84628A01	NUT, transistor mounting
	29-83208M01	LUG, soldering

TLF6432A Hybrid IPA Pre Driver Amplifier PL-8160-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C610, 611	21-84736E29	7.5 pF ± 0.25 pF; 50 V
C612, 613	21-84736E16	10 pF ± 0.5 pF; 50 V
C614	21-84547A24	.01 uF ± 20%, 25 V
C615, 616	21-84736E12	39 pF ± 5%; 50 V
C617	21-84736E29	7.5 pF ± 0.25 pF; 50 V
		coil, rf:
L610, 611	24-80202B03	3 turns
		transistor: (see note)
Q602	48-84411L70	NPN, type M1170
		mechanical parts
	42-80164B01	RETAINER
	42-80165B01	CLIP, retainer (2 used)
	42-82672N01	STRAP, connecting
	64-84255K03	PLATE, ground strap

TLF6442A Hybrid IPA Driver Amplifier PL-8161-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C620 thru 623	21-84736E15	12 pF ± 5%; 50 V
C624, 625	21-84736E12	39 pF ± 5% 50 V
C626	21-84547A24	0.1 uF ± 20%, 25 V
		coil, rf:
L620, 621	24-80202B01	3 turns
		transistor: (see note)
Q603	48-84411L71	NPN; type M1171
		resistor, fixed:
R620	6-185B55	10 ± 10%, 1/8 W
		mechanical parts
	29-83208M01	LUG, soldering; 2 used
	42-80164B01	RETAINER, driver
	42-80165B01	CLIP, retainer; 2 used
	42-82672N01	STRAP, connector

TLF6452A Hybrid IPA Final Amplifier PL-8162-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C630, 631	21-84736E15	12 pF ± 5%; 50 V
C632, 633	21-84736E45	14 pF ± 5%; 50 V
C634, 635	21-84736E12	39 pF ± 5%; 50 V
		coil, rf:
L630	24-80202B02	3 turns
L631, 632	24-80202B01	3 turns
		transistor: (see note)
Q604	48-84411L72	NPN, type M1172
		resistor, fixed:
R630	6-185B55	10 ± 10%; 1/8 W
		mechanical parts
	29-83208M01	LUG, soldering; 2 used
	42-80164B01	RETAINER, driver
	42-80165B01	CLIP, retainer; 2 used
	42-82672N01	STRAP, connector

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers

TRN4849A Heat Sink and Hardware IPA PL-8207-O

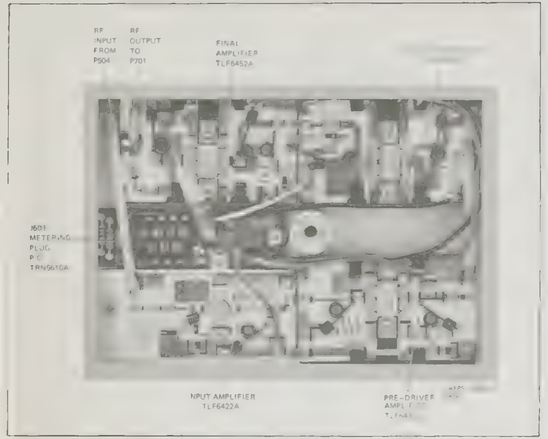
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-118030	SCREW, machine; 10-32 x 1"; 2 used
	3-124432	SCREW, machine, 4-40 x 1/4"; 11 used
	3-129674	SCREW, machine; 4-40 x 3/16"; 2 used
	3-135084	SCREW, tapping; 4-40 x 5/16", 8 used
	3-135980	SCREW, tapping; 10-32 x 1/2"; 2 used
	3-136851	SCREW, machine: 10-32 x 3/8"
	3-136886	SCREW, machine, 4-40 x 3/8"
	14-82538N01	INSULATOR, heat sink
	15-82348N01	COVER, IPA, heat sink
	26-82349N01	HEAT SINK
	30-83794C01	CABLE, coaxial; WHT; 2.2"
	32-82532M02	GASKET, RFI cover
	42-10128A10	RETAINER, ring, 3 used
	42-10217A15	STRAP, tie
	42-84510M02	STRAP, PA, 5 used
	43-10646A09	STANDOFF, 4-40 x .188, 2 used
	43-82252H01	BUSHING 2 used
	43-82345N01	STAND OFF (feed-thru)

TKN8213A Cable DC and Bracket IPA PL-8164-O

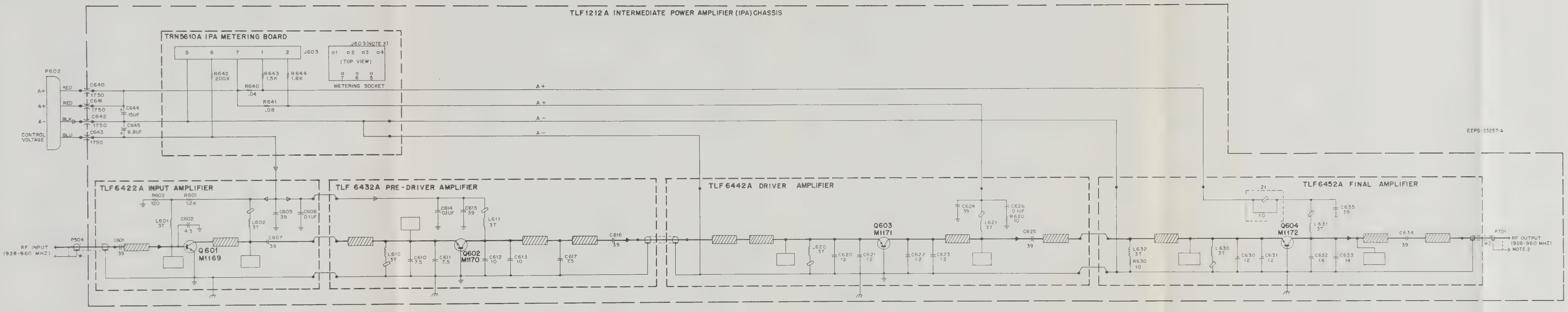
REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		filter, RFI:
C640 thru 643	91-87511C01	1750 pF, 125 V
C644	23-83214C26	15 uF
C645	23-83214C21	6.8 uF
		connector, plug:
P504	28-83099K01	male, single contact
P602	15-83498F07	housing, 6-contact
P701	28-83099K01	male, single contact
	42-10217A01	strap, tie
		cable
W1	1-80761D57	Assembly cable coaxial input, includes
	30-83794C01	CABLE, coaxial, 10" used
	37-82603D01	SLEEVING, coded #1 and refer P504
W2	1-80761D58	Assembly cable coaxial out includes
	30-83794C01	CABLE, coaxial, 10 3/4" used
	37-82603D02	SLEEVING, coded #2 and refer P701
W3	1-80761D76	Assembly cable with connector, includes
	29-83499F01	TERMINAL, 4 used
	42-10217A02	STRAP, tie
	46-84549F01	PLUG, polarizing and refer P602
		mechanical parts
	7-82344N01	BRACKET, feed-thru
	42-10217A15	STRAP, tie

TRN5610A IPA Metering Board PL-8183-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle:
J603	9-84207B01	female; 7-contact
		resistor, fixed:
R640	6-84415K02	.04 ± 5%, 2.5 amp
R641	17-82350A14	.08 ± 10%, 1 W
R642	6-11009F05	200k ± 5%; 1/4 W
R643	6-11009C53	1.5k ± 5%; 1/4 W
R644	6-11009C55	1.8k ± 5%; 1/4 W
Z1	1-80738D19	Assembly bead & resistor, includes:
	6-125C01	10 ± 10%, 1/2 W
	76-84069B01	ferrite bead


RF
INPUT
FROM
P504
RF
OUTPUT
TO
P701
FINAL
AMPLIFIER
TLF6452A
J603
METERING
PLUG
P C
TRN5610A
INPUT AMPLIFIER
TLF6422A
PRE-DRIVER
AMPLIFIER

IPA BOARD IDENTIFICATION


TLF1212A INTERMEDIATE POWER AMPLIFIER (IPA) CHASSIS
TRN5610A IPA METERING BOARD
5
6
7
1
2
J603
J603(NOTE 3)
o1 o2 o3 o4
(TOP VIEW)
o o o
7 6 5
METERING SOCKET
R642
200K
R643
1.5K
R644
1.8K
R640
.04
R641
.08
P602
A+
A+
A-
CONTROL VOLTAGE
RED
RED
BLK
BLU
C640
1750
C641
1750
C642
1750
C643
1750
C644
15UF
C645
6.8UF
A+
A+
A-
A-
EEPS-33257-A
TLF6422A INPUT AMPLIFIER
R602
120
R601
1.2K
L601
3T
C602
4.3
L602
3T
C605
39
C606
.01UF
RF INPUT
(928-960 MHZ)
P504
W1
C601
39
Q601
M1169
C607
39
TLF 6432A PRE-DRIVER AMPLIFIER
C614
0.1UF
C615
39
L611
3T
L610
3T
C610
7.5
C611
7.5
Q602
M1170
C612
10
C613
10
C617
7.5
C616
39
TLF6442A DRIVER AMPLIFIER
L620
3T
C620
12
C621
12
Q603
M1171
C622
12
C623
12
C624
39
C626
.01UF
R620
10
L621
3T
C625
39
TLF6452A FINAL AMPLIFIER
L632
3T
R630
10
L630
3T
C630
12
C631
12
Z1
10
Q604
M1172
L631
3T
C635
39
C632
14
C633
14
C634
39
P701
W2
RF OUTPUT
(928-960 MHZ)
NOTE 2

NOTES

1. Unless otherwise indicated, resistor values are in ohms and capacitor values are in picofarads

2. IPA output power varies from 0 to greater than 14 W depending proportionally upon the control voltage applied to the collectors of Q601 and Q602

3. J603 used to measure Q603 and Q604 collector current, as well as collector voltage applied to Q601 and Q602. Refer to the IPA Troubleshooting Chart for normal meter readings

TLF1212A IPA Chassis Model Complement

TKN8213A	IPA Cable & Metering Kit
TLF6422A	1st Controlled Amplifier Module
TLF6432A	2nd Controlled Amplifier Module
TLF6442A	Predriver Amplifier Module
TLF6452A	Driver Amplifier Module
TRN4849A	Heat Sink & Hardware Kit

NOTE

Modules are not field repairable. Order replacement by kit number TLFXXXX

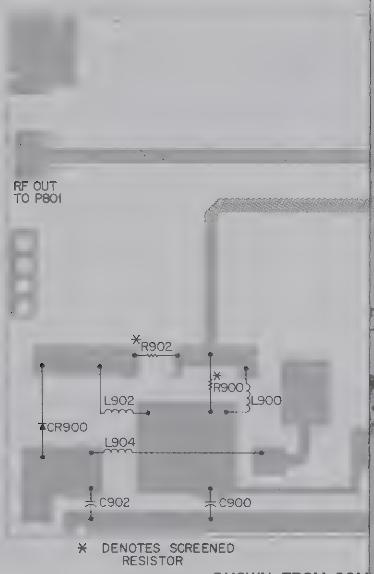
TLF1212A IPA Schematic Diagram,
Circuit Board Detail and Parts List
Motorola No. PEPS-35504-O
(Sheet 2 of 2)
12 1 82- UP

DIRECTIONAL COUPLER

MODEL TLF1232A

1. FUNCTIONAL OPERATION

The TLF1232A Directional Coupler samples bot forward and reverse power of the intermediate powe amplifier. A sample of forward and reverse power i detected by CR900 and CR901 and sent, as a dc contro voltage, to the power control board. The power contro



* DENOTES SCREENED RESISTOR

SHOWN FROM COM

J701,
FROM IPA
OUTPUT

FAEPS–35561–O
(O606)

MPONENT LOCATION

parts list

TRN4989A Hybrid Directional Coupler PL-8167-

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C900 thru 904	21-84873H63	39 pF ± 5%
		diode: (see note)
CR900, 901	48-84616A07	hot carrier
		coil, rf:
L900, 901	24-83035N11	11 turns
L902, 903	24-84331M47	7 turns
L904, 905	24-82723H40	choke; 0.29 uH
	mechanical parts	
	7-84198N01	FRAME
	29-83208M01	LUG, soldering; 3 used

note: For optimum performance, diodes, transistors, and integrated circuits mus be ordered by Motorola part numbers.

DIRECTIONAL COUPLER

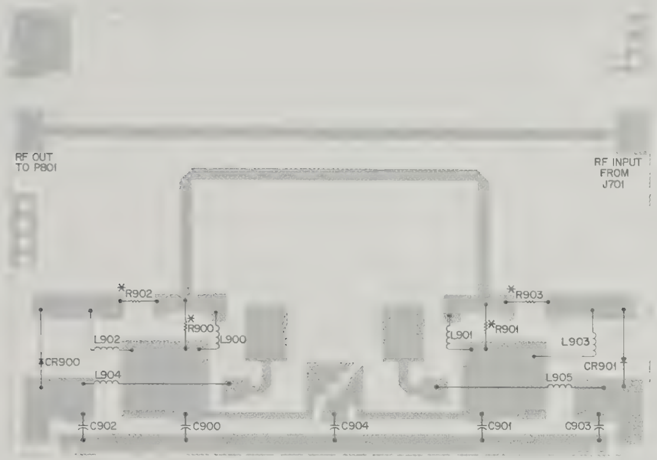
MODEL TLF1232A

1. FUNCTIONAL OPERATION

The TLF1232A Directional Coupler samples both forward and reverse power of the intermediate power amplifier. A sample of forward and reverse power is detected by CR900 and CR901 and sent, as a dc control voltage, to the power control board. The power control board uses these voltages to control the output of the IPA and thus the output of the transmitter.

2. MAINTENANCE AND TROUBLESHOOTING

The directional coupler contains hybrid microstrip circuitry and should be considered a non-repairable item.


RF OUT TO P801
RF INPUT FROM J701
R902
R900
L900
L902
CR900
L904
R903
L901
R901
L903
CR901
L905
C902
C900
C904
C901
C903

* DENOTES SCREENED RESISTOR

COMPONENT SIDE BD-CEPS-35267-O OL-CEPS-35268-O

SHOWN FROM COMPONENT SIDE

parts list

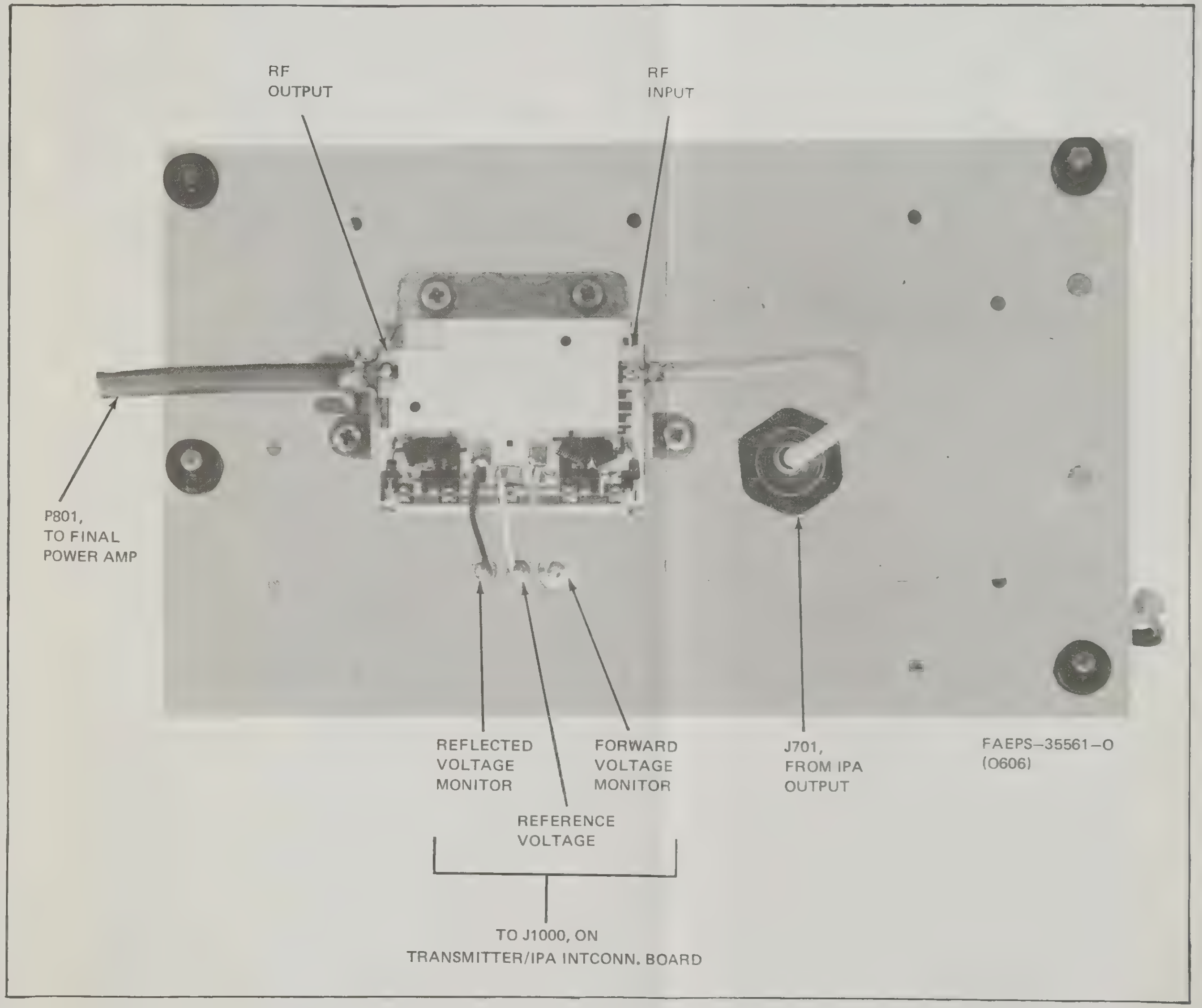
TRN4989A Hybrid Directional Coupler PL-8167-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C900 thru 904	21-84873H63	39 pF ± 5%
		diode: (see note)
CR900, 901	48-84616A07	hot carrier
		coil, rf:
L900, 901	24-83035N11	11 turns
L902, 903	24-84331M47	7 turns
L904, 905	24-82723H40	choke; 0.29 uH
		mechanical parts
	7-84198N01	FRAME
	29-83208M01	LUG, soldering; 3 used

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TKN8226A Cable and Hardware Coupler PL-8182-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle:
P1000	15-83498F06	housing; 6-contact
J701	9-84968D01	female; single contact
		connector, plug:
P907	28-852527	male, single contact
		mechanical parts
	3-134169	SCREW, tapping: 4-40 × 1/4"; 10 used
	3-138162	SCREW, tapping: 4-40 × 3/8"; 4 used
	15-82045L02	COVER, directional coupler
	42-10217A02	STRAP, tie .091 × 3.62; 4 used
	1-80738D18	CABLE ASSY, dc
	42-84284B01	RETAINER; 4 used
	29-83499F01	TERMINAL; 3 used
	46-84549F01	PLUG; polarizing
	1-80761D36	Assembly directional coupler feed-thru includes:
	1-80761D35	Assembly plate coupler mounting includes:
	5-84500B03	EYELET, special; (4 used)
	64-82428N01	PLATE, coupler
	91-87511C01	FILTER RF1
	1-80761D34	Assembly cable rf coupler out; includes ref. P907
	30-84173E01	CABLE, coaxial; 14" used
	1-80740D66	Assembly cable coupler; includes ref J701
	30-83794C01	CABLE, coaxial; 4 1/4" used
	3-135102	SCREW, tapping: 4-40 × 1/4"; 4 used


RF OUTPUT
RF INPUT
P801, TO FINAL POWER AMP
REFLECTED VOLTAGE MONITOR
REFERENCE VOLTAGE
FORWARD VOLTAGE MONITOR
J701, FROM IPA OUTPUT
FAEPS-35561-O (O606)
TO J1000, ON TRANSMITTER/IPA INTCONN. BOARD

DIRECTIONAL COUPLER COMPONENT LOCATION

MOTOROLA INC.
Communications
Sector

POWER CONTROL BOARD

MODEL TRN4845A

1. DESCRIPTION

The power control board operates as a control loop which continually monitors the output of the intermediate power amplifier (IPA) and controls that output by regulating the collector voltage applied to the IPA controlled stage.

2. CONTROL THEORY

2.1 GENERAL

Two integrated circuits are used to develop the control functions. Reflected voltage is amplified by IC602, which controls the bias to IC601. This amplified voltage and the forward voltage are compared by IC601. The output of IC601 (through Q601) regulates the base current to control stage Q902 (mounted on the unified chassis) which is used to bias the IPA driver stage.

2.2 VSWR PROTECTION CIRCUITRY

When the VSWR approaches 2.5:1, forward power from the IPA must be reduced to prevent IPA oscillation or damage. During normal operation, the voltage at J1004-3 (reflected) and J1004-2 (reference) is approximately 5 volts, producing a 5 volt output from IC602. Since the voltage at pin 5 of IC601 is normally 5.5 volts (with 14 watts of output from the IPA), CR604 is reverse biased. When excessive VSWR is present, the voltage at J1004-3 drops, causing the voltage at pin 6 of IC602 to increase. When the potential at pin 6 reaches a sufficiently high level, CR604 conducts (reflected voltage at J1004-3 remains constant and forward voltage at J1004-4 decreases as VSWR increases). When CR604 becomes forward biased, the voltage at pin 5 of IC601 increases and pin 8 becomes more positive, decreasing the drive to Q902 thus lowering the control voltage to the IPA.

3. POWER CONTROL BOARD MAINTENANCE

NOTE

The power control board must be installed in a transmitter for testing to provide the necessary power, ground, and control connections. For bench testing of a board that has been removed from the radio set and replaced by a spare, another radio set is required as a test fixture for troubleshooting.

3.1 PERFORMANCE TESTS

3.1.1 Power Set Control Test

This control allows the power output of the IPA to be varied from zero (0) power out with the control fully counterclockwise to greater than the rated output. Refer to the intermediate power amplifier section of this manual.

CAUTION

For proper operation of the protection circuitry, it is imperative that the POWER SET control never be left in a position that exceeds rated power output.

Step 1. Key the transmitter.

Step 2. Adjust the POWER SET control until the rated power output is reached. Refer to the Power Setting Procedure in the Intermediate Power Amplifier section of this manual.

Step 3. Unkey the transmitter.

POWER CONTROL BOARD

3.1.2 Drive Limit Control

3.1.2.1 This control allows the drive power to the power amplifier from the controlled stage to be limited to a level sufficient to provide rated performance. Its purpose is to set a limit on the drive power that can be called for by the automatic power leveling circuitry. This prevents earlier IPA stages from being damaged by overdrive if later stages fail. Depending on the position of the Drive Limit Control, the maximum collector voltage of the controlled stage can be limited to between 6.5 volts and 12.5 volts. The proper procedure for setting the Drive Limit Control is given in the Intermediate Power Amplifier section of this manual.

CAUTION

For proper operation of the power leveling circuitry, the Drive Limit control *must not* be set for any lower output than that given in the IPA section of this manual.

3.1.2.2 In some stations, the power leveling circuitry may operate the controlled stage at a collector voltage more than 12 volts. In such stations, little or no effect will be seen from the Drive Limit Control. If it is not possible to lower power output by the Drive Limit Control to the level called for, set the Drive Limit Control to its maximum clockwise position (maximum drive limits).

4. TROUBLESHOOTING

4.1 GENERAL

Efficient location of power control board faults requires a thorough knowledge of theory of operation. In any case, it is a good idea to review theory and the schematic diagram before performing troubleshooting procedures.

4.2 PROCEDURE

Step 1. Couple the IPA into a through-line wattmeter and a 50 ohm load to the directional coupler.

Step 2. Perform the power set control and Drive Limit Control tests given in paragraph 3. If the power control board does not control the IPA, proceed to Step 3. If there is no IPA power output, proceed to Step 4.

Step 3. If the power control board does not control or level IPA power, turn R609 fully counterclockwise and R607 fully clockwise (with respect to solder side). Key the station and read meter position 1 on the station metering kit or portable test set.

A. If the reading is less than 5.0 uA, inspect the wiring from the directional coupler to the transmitter interconnect board. If wiring is proper, check R610 and proceed to Step 3C.

B. Key the station. Measure and record the following directional coupler voltages:

voltage at white lead ________________
voltage at yellow lead ________________

If the voltage at the white lead is not between 4.5 and 6.0 volts, proceed to Step 3C. If the voltage at the white lead is between 4.5 and 6.0 volts and the voltage at the yellow lead is less than 4.5 volts, the problem is in the directional coupler (see section 68P81063E22). If the voltage at the white lead is between 4.5 and 6.0 volts and the voltage at the yellow lead is greater than 4.5 volts, look for broken wires or plating on the transmitter interconnect board.

C. Measure the voltage at the anode of CR607. If the voltage is not between 4.5 and 6.0 volts, check the voltage at the emitter of Q602 (8.3 volts ±20%).

D. Measure the voltage at pin 1 of IC601. If the voltage is greater than 7 volts, check R604, R617, CR606, CR605, and R613.

E. Remove F1 on the unified chassis (7.5 amp). Key the station and measure the voltage at pin 5 of IC601 while varying R607 from minimum to maximum. If pin 5 does not vary from approximately 2.0 to 6.0 volts, check R605, R606, and R607. Reconnect F1.

F. Turn R609 fully counterclockwise. Key the station and, while varying R607 from maximum to minimum, measure the voltage at pin 8 of IC601. If pin 8 does not vary from 2 to 11 volts, check Q601 and, if good, replace IC601 (IC601 is usually malfunctioning if this occurs).

G. Key the station. Measure the voltage at the emitter of Q601 while varying R607. If the voltage does not vary from 3 to 14 volts, check Q601, Q902 (on transmitter interconnect board), and CR601.

Step 4. If there is no power output from the IPA:

A. Terminate the triper/doubler amplifier into a wattmeter and a 50 ohm load. Power output should be greater than 1.3 watts. If less than 1.3 watts, check the tripler and doubler and the exciter. Reconnect the tripler/doubler amplifier to the IPA.

B. Turn R607 fully clockwise and R609 fully counterclockwise. Key the station and measure the voltages at the IPA input. Both the blue and red wire leads should be between 11 and 16 volts. If red lead is less than 11 volts, inspect F1 on the unified chassis, the power supply, and the plating on the transmitter interconnect board. If the blue lead is less than 11 volts, proceed to Step 4C. If both red and blue leads are greater than 11 volts and there is still no power output, the IPA is faulty and/or there is no input power.

C. Key the station and measure the voltage at the cathode of CR609. If less than 11 volts, check CR609 and the 9.6 and 13.6 volt regulator board on the low voltage power supply.

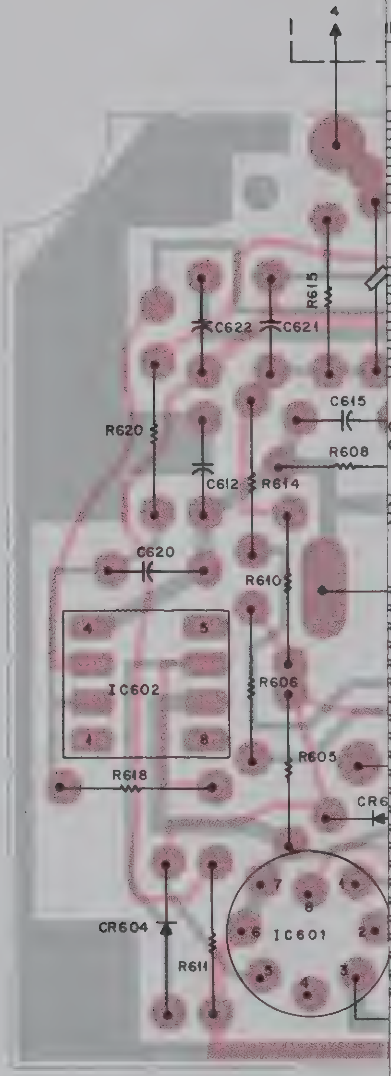
D. Insure that the station is unkeyed and measure the voltage at the collector of Q601. The voltage should be greater than 11 volts. Key the station. If the voltage at Q601 collector does not drop to 0.3 volts, check the station control module.

E. Key the station and measure the voltage at the emitter of Q602. If not 8.2 volts ±20%, check Q602 and CR602.

F. Short out R604 and key the station. If power from the IPA is still zero, check pin 8 of IC601. If greater than 5 volts, replace IC601. Measure the voltage at the emitter of Q601. If greater than 5 volts, check R908, CR601, R603, and Q601.

Step 5. If the power control board does not limit the drive to the IPA, set the IPA power output at 14 watts (R607). Read power control board meter position 5. This reading will vary but in all cases should be less than 38 uA. If less than 38 uA, check CR603 and R609. If greater than 38 uA, check CR610.

Step 6. If there is no power cutback under excessive VSWR conditions, remove the lead of R618 that connects with J1004-3. Connect this lead to a 0-6 volt variable power supply and terminate the IPA into a 50 ohm load. Key the station and adjust the power supply to 6.0 volts. Adjust R607 until 14 watts of output power is obtained from the IPA. If output power cannot be varied, check CR604 and R607. Vary the 0-6 volt power supply. IPA output power should increase and decrease smoothly. If power drops abruptly, check R618 and R620. If no power change is noticed, replace U602.



SHOWN FROM SOLDE

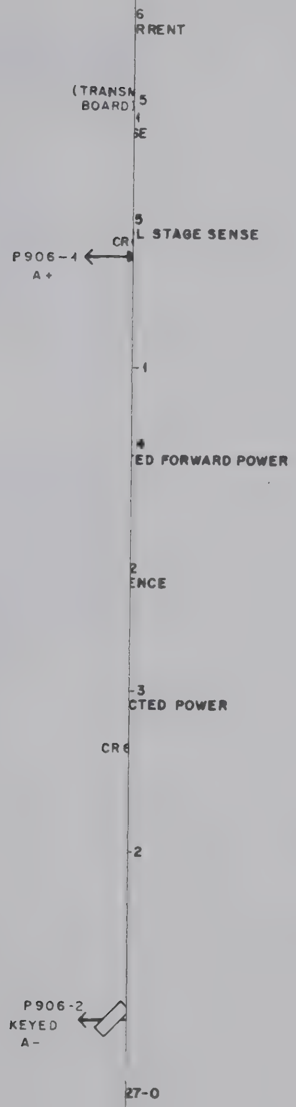
arts list

N4845A Power Control Board PL-8195-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C602 thru 605	21-82355B39	4.7 pF; 0.25 pF; 500 V
C606	23-84538G08	2.2 uF ± 20%; 20 V
C608 thru 622	21-82355B39	4.7 pF; 0.25 pF; 500 V
C623	21-82372C07	.05 uF + 80-20%; 25 V
C624, 625	21-82355B39	4.7 pF; 0.25 pF; 500 V
C626	23-82783B48	0.68 uF ± 10%
		diode: (see note)
CR601	48-83654H01	silicon
CR602	48-83696E04	silicon
CR603	48-4616A01	hot carrier
CR604	48-2392B03	silicon
CR605 thru 607	48-82392B18	silicon
CR609	48-82466H18	silicon
CR610	48-82392B03	silicon
		integrated circuit: (see note)
C601	51-84320A02	M2002
C602	51-34320A13	M2013
		transistor: (see note)
Q601	48-869641	PNP; M9641
Q602	48-860570	NPN; M9570
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R601	6-124C15	39 ± 10%
R602	6-124A45	680
R603	6-124C49	1k ± 10%
R604	6-124A75	12k
R605	6-124A83	27k
R606	6-124C23	10k ± 10%
R607	18-83083G20	variable; 50k ± 30%
R608	6-124A75	12k
R609	18-83-83G14	variable; 1k ± 30%
R610	6-124C83	27k ± 10%
R611	6-124A39	390
R612	6-124A45	680
R613	6-124C89	47k ± 10%
R614	6-124C83	27k ± 10%
R615	6-124C77	15k ± 10%
R616	6-124A61	3.3k
R617	6-124A69	6.8k
R618	6-124A74	11k
R619	6-124A89	47k
R620	6-124A83	27k
R621	6-124C25	100 ± 10%
R622	6-124D08	270k ± 10%
R623	6-124A71	8.2k
		non-referenced items
	3-134169	SCREW, tapping: 4-40 × 1/4"
	3-129506	SCREW, tapping: 4-40 × 5/16"; 4 req'd.
	5-84220B01	GROMMET
	9-84207B01	CONNECTOR, 7-contact
	42-84284B01	RETAINER, screw; 4 req'd.
	55-84300B02	HANDLE; 1.83" lg.
	55-84973E01	HANDLE; 1.40" lg.
	76-84069B01	FERRITE BEAD; 3 req'd.
	1-80785B27	CIRCUIT BOARD ASSEMBLY includes:
	29-84028H01	TERMINAL, male; 9 req'd.
	5-84500B03	EYELET, special; 4 req'd.

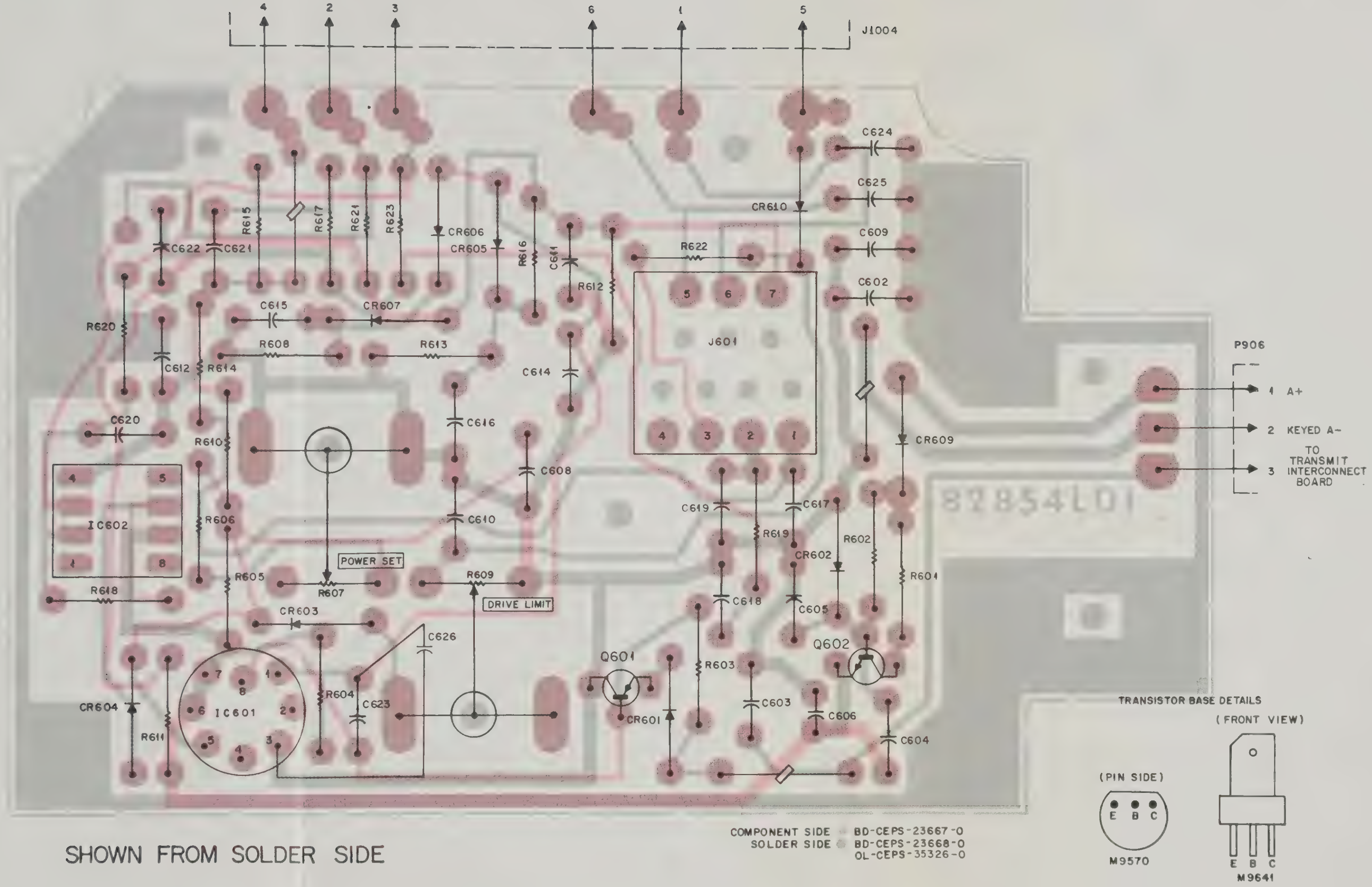
e: For optimum performance, diodes, transistors, and integrated circuits must ordered by Motorola part numbers.

TRN4845A Power Control Board
Schematic Diagram, Circuit Board Detail,
and Parts List
(Sheet 1 of 2)
Motorola No. PEPS-35506-O
12/1/82- UP


6
RRENT
(TRANSM
BOARD)
5
SE
5
L STAGE SENSE
CR
P906-4
A+
-4
ED FORWARD POWER
2
ENCE
-3
CTED POWER
CR6
-2
P906-2
KEYED
A-
27-0

TRN4845A Power Control Board
Schematic Diagram, Circuit Board Detail
and Parts List
(Sheet 2 of 2)
Motorola No. PEPS-35506-O
12/1/82- UP

POWER CONTROL BOARD


J1004
4
2
3
6
1
5
C624
C625
CR610
C609
C602
C622
C621
R615
R617
R621
R623
CR606
CR605
R616
C611
R612
R622
J601
5
6
7
4
3
2
1
R620
C615
CR607
C612
R614
R608
R613
C614
C620
R610
C616
C608
IC602
4
5
1
8
R606
C610
C619
C617
R619
R602
CR602
R604
CR609
POWER SET
R607
R605
R609
DRIVE LIMIT
R618
C618
C605
CR603
C626
Q601
R603
Q602
IC601
7
8
1
6
2
5
4
3
R604
C623
CR601
C603
C606
C604
CR604
R611
82854L01
P906
1 A+
2 KEYED A−
3 TO TRANSMIT INTERCONNECT BOARD
COMPONENT SIDE ▨ BD-CEPS-23667-0
SOLDER SIDE ▨ BD-CEPS-23668-0
OL-CEPS-35326-0
TRANSISTOR BASE DETAILS
(FRONT VIEW)
(PIN SIDE)
E B C
M9570
E B C
M9641

SHOWN FROM SOLDER SIDE

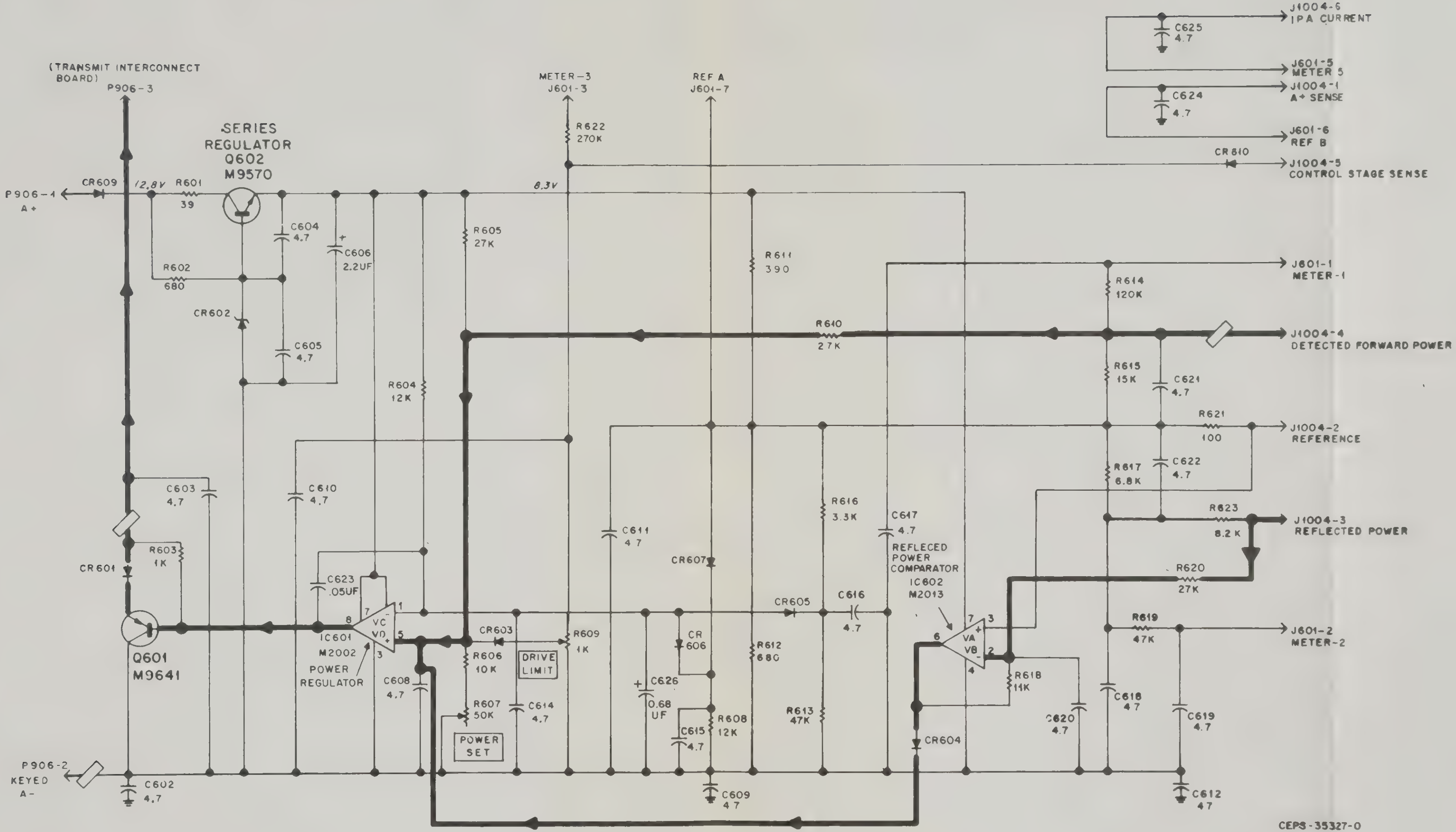
parts list

TRN4845A Power Control Board PL-8195-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C602 thru 605	21-82355B39	4.7 pF; 0.25 pF; 500 V
C606	23-84538G06	2.2 uF ± 20%; 20 V
C608 thru 622	21-82355B39	4.7 pF; 0.25 pF; 500 V
C623	21-82372C07	.05 uF + 80-20%; 25 V
C624, 625	21-82355B39	4.7 pF; 0.25 pF; 500 V
C626	23-82783B48	0.68 uF ± 10%
		diode: (see note)
CR601	48-83654H01	silicon
CR602	48-83696E04	silicon
CR603	48-4616A01	hot carrier
CR604	48-2392B03	silicon
CR605 thru 607	48-82392B18	silicon
CR609	48-82466H18	silicon
CR610	48-82392B03	silicon
		integrated circuit: (see note)
IC601	51-84320A02	M2002
IC602	51-34320A13	M2013
		transistor: (see note)
Q601'	48-869641	PNP; M9641
Q602	48-860570	NPN; M9570
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R601	6-124C15	39 ± 10%
R602	6-124A45	680
R603	6-124C49	1k ± 10%
R604	6-124A75	12k
R605	6-124A83	27k
R606	6-124C23	10k ± 10%
R607	18-83083G20	variable; 50k ± 30%
R608	6-124A75	12k
R609	18-83-83G14	variable; 1k ± 30%
R610	6-124C83	27k ± 10%
R611	6-124A39	390
R612	6-124A45	680
R613	6-124C89	47k ± 10%
R614	6-124C83	27k ± 10%
R615	6-124C77	15k ± 10%
R616	6-124A61	3.3k
R617	6-124A69	6.8k
R618	6-124A74	11k
R619	6-124A89	47k
R620	6-124A83	27k
R621	6-124C25	100 ± 10%
R622	6-124D08	270k ± 10%
R623	6-124A71	8.2k
		non-referenced items
	3-134169	SCREW, tapping: 4-40 × 1/4"
	3-129506	SCREW, tapping: 4-40 × 5/16"; 4 req'd.
	5-84220B01	GROMMET
	9-84207B01	CONNECTOR, 7-contact
	42-84284B01	RETAINER, screw; 4 req'd.
	55-84300B02	HANDLE; 1.83" lg.
	55-84973E01	HANDLE; 1.40" lg.
	76-84069B01	FERRITE BEAD; 3 req'd.
	1-80785B27	CIRCUIT BOARD ASSEMBLY includes:
	29-84028H01	TERMINAL, male; 9 req'd.
	5-84500B03	EYELET, special; 4 req'd.

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN4845A Power Control Board
Schematic Diagram, Circuit Board Detail,
and Parts List
(Sheet 1 of 2)
Motorola No. PEPS-35506-O
12/1/82- UP


(TRANSMIT INTERCONNECT BOARD)
P906-3
SERIES REGULATOR Q602 M9570
P906-4 A+
CR609
12.8V
R601 39
R602 680
CR602
C604 4.7
C606 2.2UF
C605 4.7
R605 27K
R604 12K
METER-3 J601-3
R622 270K
8.3V
REF A J601-7
R611 390
J1004-6 IPA CURRENT
C625 4.7
J601-5 METER 5
J1004-1 A+ SENSE
C624 4.7
J601-6 REF B
CR610
J1004-5 CONTROL STAGE SENSE
J601-1 METER-1
R614 120K
R610 27K
J1004-4 DETECTED FORWARD POWER
R615 15K
C621 4.7
R621 100
J1004-2 REFERENCE
R617 6.8K
C622 4.7
R623 8.2K
J1004-3 REFLECTED POWER
R620 27K
R619 47K
J601-2 METER-2
C603 4.7
C610 4.7
R603 1K
CR601
Q601 M9641
C623 .05UF
IC601 M2002 POWER REGULATOR
VC
VD
C608 4.7
CR603
R606 10K
R607 50K
POWER SET
C614 4.7
DRIVE LIMIT
R609 1K
C611 4.7
CR607
CR 606
C626 0.68 UF
C615 4.7
R608 12K
C609 4.7
R612 680
R613 47K
R616 3.3K
CR605
C616 4.7
C617 4.7
REFLECED POWER COMPARATOR IC602 M2013
VA
VB
R618 11K
C620 4.7
C618 4.7
C619 4.7
C612 4.7
CR604
P906-2 KEYED A-
C602 4.7
CEPS-35327-0

NOTES

1. UNLESS OTHERWISE INDICATED, CAPACITOR VALUES IN PICOFARADS.
2. INDICATES FERRITE BEAD.

TRN4845A Power Control Board
Schematic Diagram, Circuit Board Detail
and Parts List
(Sheet 2 of 2)
*Motorola No. **PEPS-35506-O***
12/1/82- UP

MOTOROLA INC.
Communications
Sector

FINAL POWER AMPLIFIER
MODEL TLF1222A
BLOWER AND SHROUD
MODEL TRN6729A

TLF1222A
Final PA Model Complement

Model	Description
TKN6835A	Cable Kit
TLF6472A	Amplifier Cavity
TRN4850A	Chassis and Hardware Kit
TRN6588A	Control Logic Board

1. FUNCTIONAL OPERATION

The output from the directional coupler is applied to the final power amplifier input coupling. The rf carrier is applied to an EIMAC 3CX400U7/8961 UHF Transmitting Triode designed primarily for the 928 to 960 MHz frequency spectrum. In the supplied grounded grid, cathode driven configuration, the tube provides 125 W of final rf output power. The carrier is coupled through a low pass harmonic filter to the antenna.

2. ALIGNMENT PROCEDURE

WARNING
High voltages are present when power is applied to the station. Under no circumstances should the station be operated with any of the power amplifier cavity screws loose. The adjustable wall screws must all be tightened before applying power to the station. Attempting to tune the adjustable walls with power applied is both improper and dangerous.

2.1 PRELIMINARY ADJUSTMENT

Step 1. Insure that no ac power is applied to the station.

Step 2. Before attempting to align the power amplifier, insure that the exciter, IPA, and low voltage power supply adjustments have been made.

Step 3. Connect a 250 watt wattmeter between the antenna output connector and the antenna.

Step 4. Loosen locking screws on the output coupling, output fine tuning, input coupling, and input fine tuning controls.

Step 5. Set the controls on amplifier as indicated below. (See Figure 1.)

- OUTPUT TUNING CONTROL — Fully ccw (as looking down on the cavity) or control knob fully extended out.
- PLATE CURRENT CONTROL — Fully ccw.
- OUTPUT COUPLING CONTROL — Fully ccw (as looking down on cavity) or control knob fully in.

Step 6. Tighten down *all* screws on power amplifier cavity, front and rear. This step is important to insure proper operation of the cavity.

2.2 TUNING PROCEDURE

After making preliminary adjustments, perform the following tuning procedure.

Step 1. Apply power to the station. After the transmitter is enabled by the transmit inhibit circuitry (see section 68P81031E53) in the Power Supplies section, key the station. Slide the coarse input coupling control in and out. Observe the best dip on power control Meter 2 reading.

NOTE
The dip can be very sharp, so move the control very slowly in small amounts.

Step 2. Alternately turn the input coupling and input tuning controls for minimum reflected power (power control Meter 2).

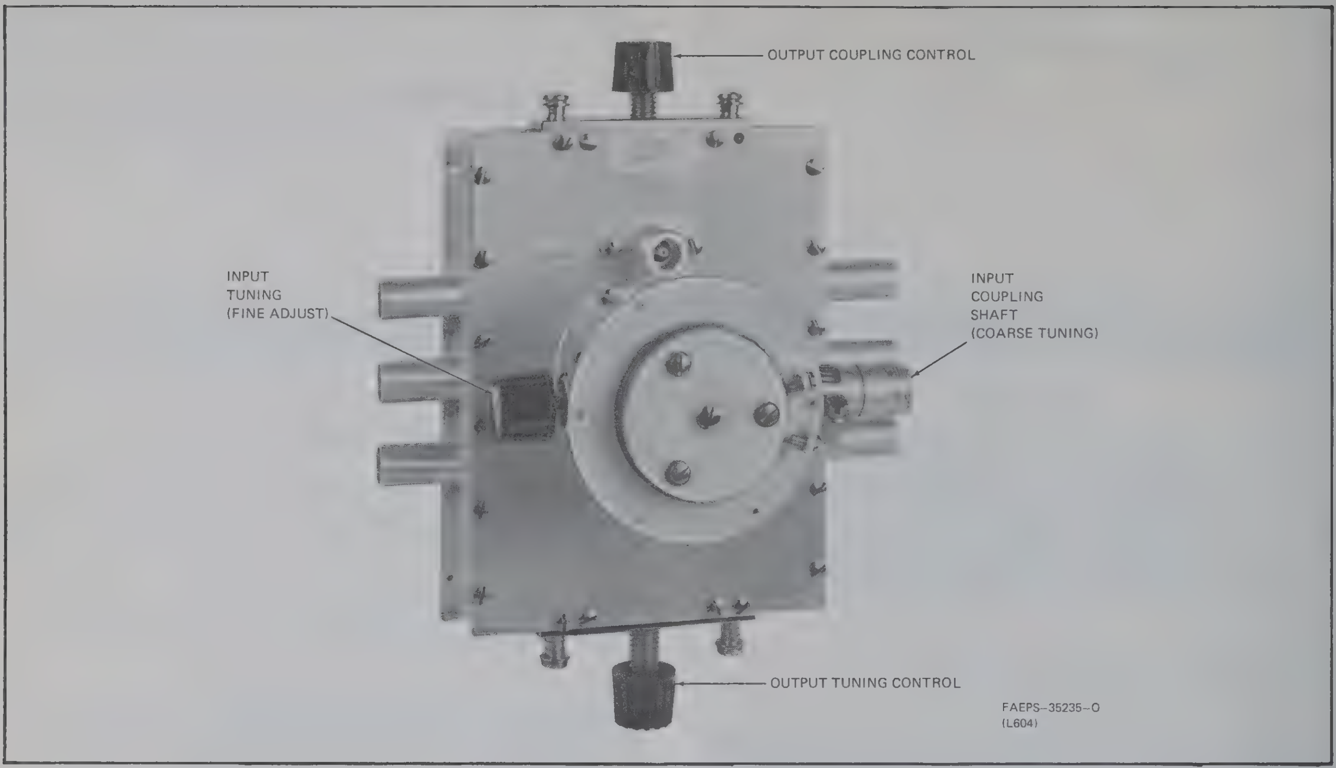


Figure 1. Final Power Amplifier Controls

Step 3. Alternately turn the output coupling and output tuning controls for maximum power output.

Step 4. Increase the plate current adjustment control to achieve approximately 300 mA or 125 W rf output, whichever comes first.

Step 5. Adjust the input tuning and input coupling controls to minimum power control Meter 2 reading.

Step 6. Adjust output tuning and output coupling controls for maximum power output. Continue adjustments until no further improvement can be obtained.

Step 7. Adjust the plate current control to achieve 125 W rf output from the station.

Step 8. Tighten down the output coupling and tuning controls and then the input coupling shaft and tuning control.

3. MAINTENANCE AND TROUBLESHOOTING

3.1 PERFORMANCE CHECKS

The power amplifier should be periodically checked for proper operation. Refer to Table 1 for typical PA check points and normal readings.

3.2 TROUBLESHOOTING

If the above performance tests indicate a PA malfunction, refer to the appropriate step in the following troubleshooting procedure.

Step 1. Apply power to the station. Measure the filament voltage. If voltage is below 6.3 volts, adjust the filament voltage (see section 68P81031E53, paragraph 4). If the voltage is zero, check the filament regulator board on the low voltage power supply.

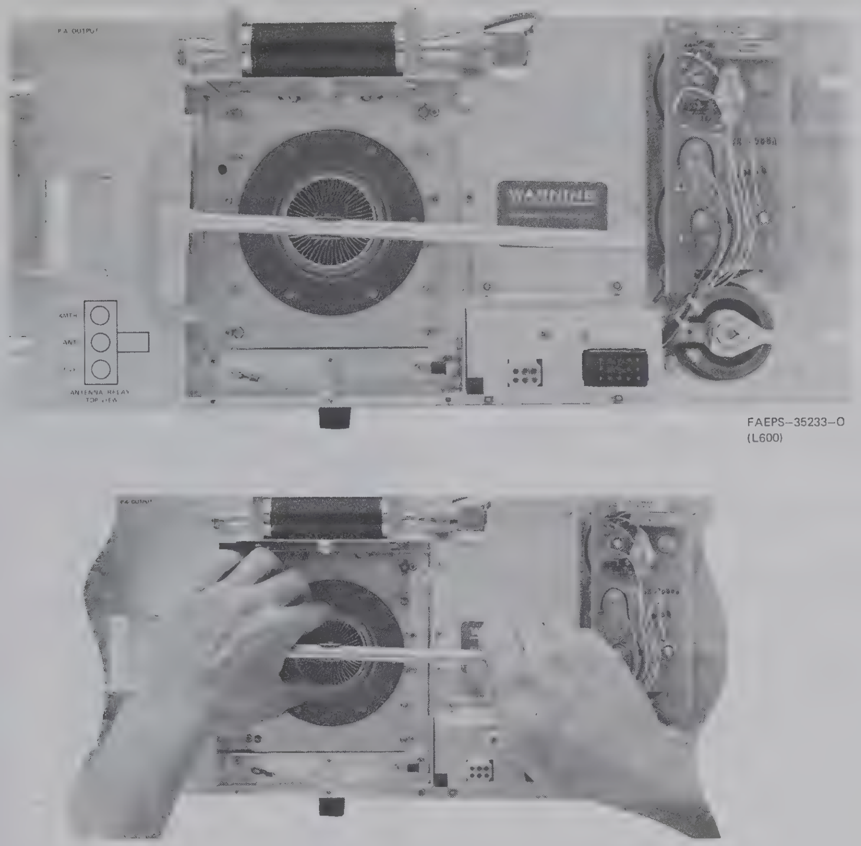
Step 2. Measure the plate voltage. If less than 1500 V dc, check the high voltage power supply (section 68P81031E52).

Table 1. Typical Final PA Meter Readings

	Meter Reading	
Test Point	**Keyed**	**Unkeyed**
Filament Voltage	4.8 V dc	6.3 V dc
Plate Voltage	1500 V dc	1500 V dc
PA Current	300 mA	—
Reflected Power	—	—
Power Output	60-125 Watts Variable	—

Step 3. Key the station and measure the output power. If power is low, perform Steps 4 through 7. If power is zero, perform Steps 8 through 9.

Step 4. Measure the filament voltage. If a value other than 4.8 V dc is obtained, adjust the filament voltage (see section 68P81031E53, paragraph 4).



FAEPS–35233–O
(L600)

FAEPS–35234–O
(O600)

Figure 2. PA Tube Pulling Procedure

Step 5. Measure the plate current. If low or high, adjust R900 to obtain a normal reading and retune the output coupling and tuning. If the plate current is zero, check the high voltage power supply (section 68P81031E52).

Step 6. Measure the power output. If output is low, retune the entire PA (see paragraph 3.2).

Step 7. If power output is still low, replace the PA tube (see paragraph 3.3).

Step 8. Measure the filament voltage. If other than 4.7 V dc, check the filament regulator board.

Step 9. Measure the plate current. If low, remove the cover to the TRN6588A Control Logic Board. Measure the collector voltage at Q900 (25 V dc unkeyed, 0 V dc keyed). If abnormal readings are obtained, check the biasing circuitry. If the biasing is functioning properly, replace Q900.

3.3 TUBE REPLACEMENT PROCEDURE

Step 1. Remove blower cover.

Step 2. Remove plate cap.

Step 3. Remove circular plastic anode clamp ring (item #24).

Step 4. Position the tube puller, with the lifting fingers under the top cap of the tube. It is essential that the puller remain parallel to the surface of the cavity during tube removal. This allows the puller to exert force correctly and avoid damaging (bending) the tube anode cap.

Step 5. With the tube puller in place, pull slowly on the handle while guiding the tube as necessary. Note that the anode collet (item #29) will still be on the tube anode collet as it comes free of the cavity. After the tube is completely in the clear, *carefully* remove the anode collet from the tube by sliding it in the stem-to-cap direction. *Be sure* the collet is not cocked during this removal step. With the tube removed, the internal tube contact collets should be visually inspected. If the rings or finger stock are bent, replacement may be required. If any contact fingers are missing, replacement of that assembly is recommended as tuning will be effected.

Step 6. Install the insulator anode dielectric (item #25), the anode collet (item #29), and the circular plastic anode clamp ring (item #24) but *allow to remain loose so the anode collet can "float"*. Visually align the tube with the socket and insert it carefully, using straight-in pressure. With the tube seated, tighten the six screws on the circular plastic anode clamp ring (item #24).

Step 7. Perform the entire tune-up procedure.

4. TRN6729A BLOWER AND SHROUD

4.1 GENERAL

The blower and shroud provides cooling for the PA tube and vents the heated air outside the cabinet. The assembly does not provide cooling for other cabinet components.

4.2 BLOWER FILTER CLEANING PROCEDURE

To insure proper operation, the filters for the PA blower must be cleaned once every six months.

Step 1. Remove filters from blower assembly.

Step 2. Clean filters either by rinsing in warm water or thoroughly vacuuming them.

Step 3. Allow filters to completely dry and replace them.

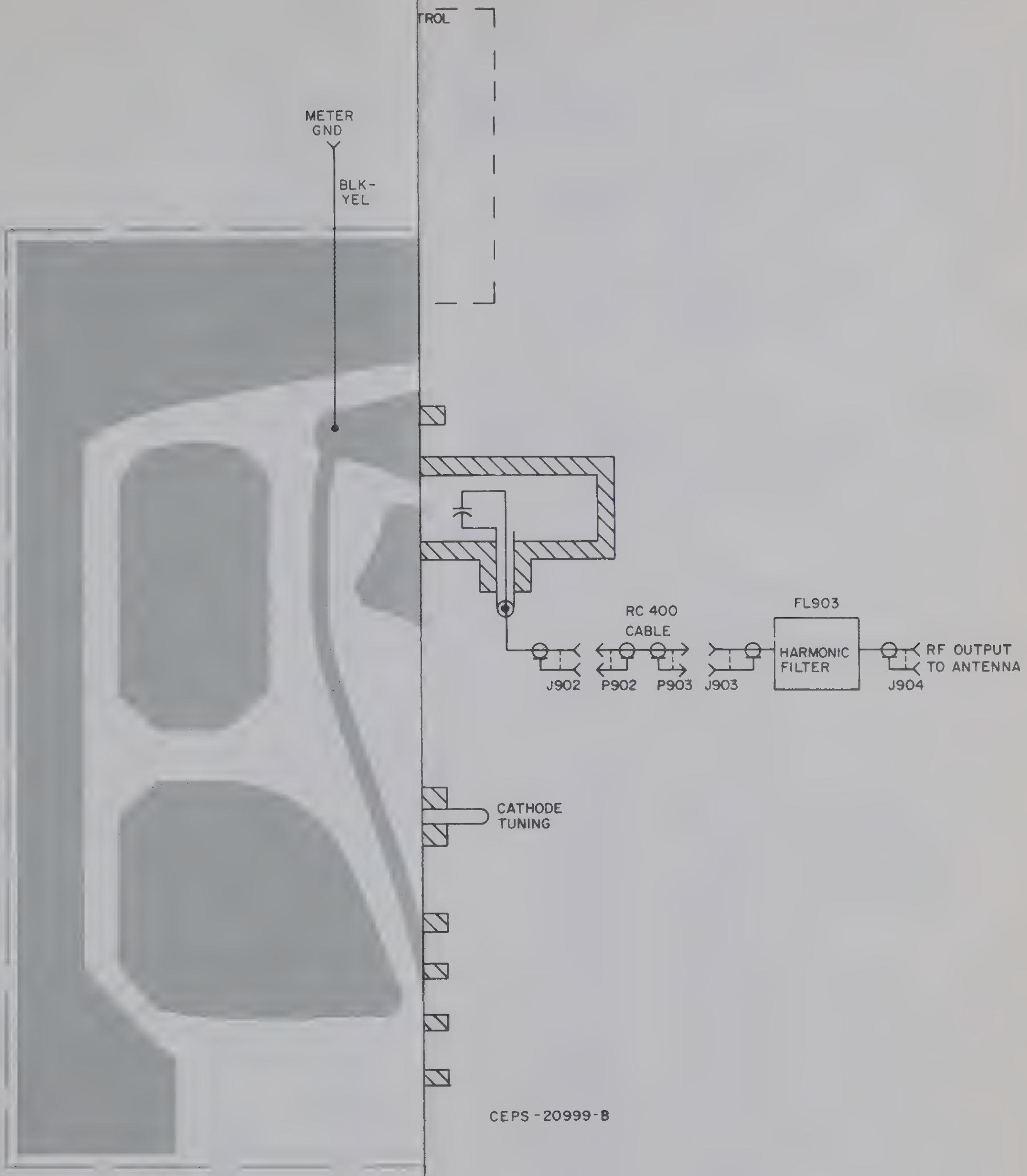
NOTE

The station can remain in operation during filter cleaning. In dusty environments, they should be cleaned more frequently (see table below).

Type of Environment	Frequency of Cleaning Filters
Heavy industrial or very dusty outdoor	Each Month
Outdoor (Average Dust)	3 Months
Average Industrial (Indoor)	6 Months
Average Residental (Indoor)	6 Months

4.3 BLOWER MAINTENANCE

The blower normally does not require maintenance. The blower motor contains lifetime lubricated, sealed bearings.


TROL
METER GND
BLK-YEL
RC 400 CABLE
FL903
HARMONIC FILTER
J902
P902
P903
J903
J904
RF OUTPUT TO ANTENNA
CATHODE TUNING
CEPS-20999-B

PARTS LISTS SHOWN ON
BACK OF THIS DIAGRAM

TLF1222A Final Power Amplifier
Schematic Diagram and Circuit Board Detail
Motorola No. ***PEPS-35507-O***
12/1/82- UP

Step 6. Install the insulator anode dielectric (item #25), the anode collet (item #29), and the circular plastic anode clamp ring (item #24) but *allow to remain loose so the anode collet can "float"*. Visually align the tube with the socket and insert it carefully, using straight-in pressure. With the tube seated, tighten the six screws on the circular plastic anode clamp ring (item #24).

Step 7. Perform the entire tune-up procedure.

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NOTE

The station can remain in operation during filter cleaning. In dusty environments, they should be cleaned more frequently (see table below).

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4.3 BLOWER MAINTENANCE

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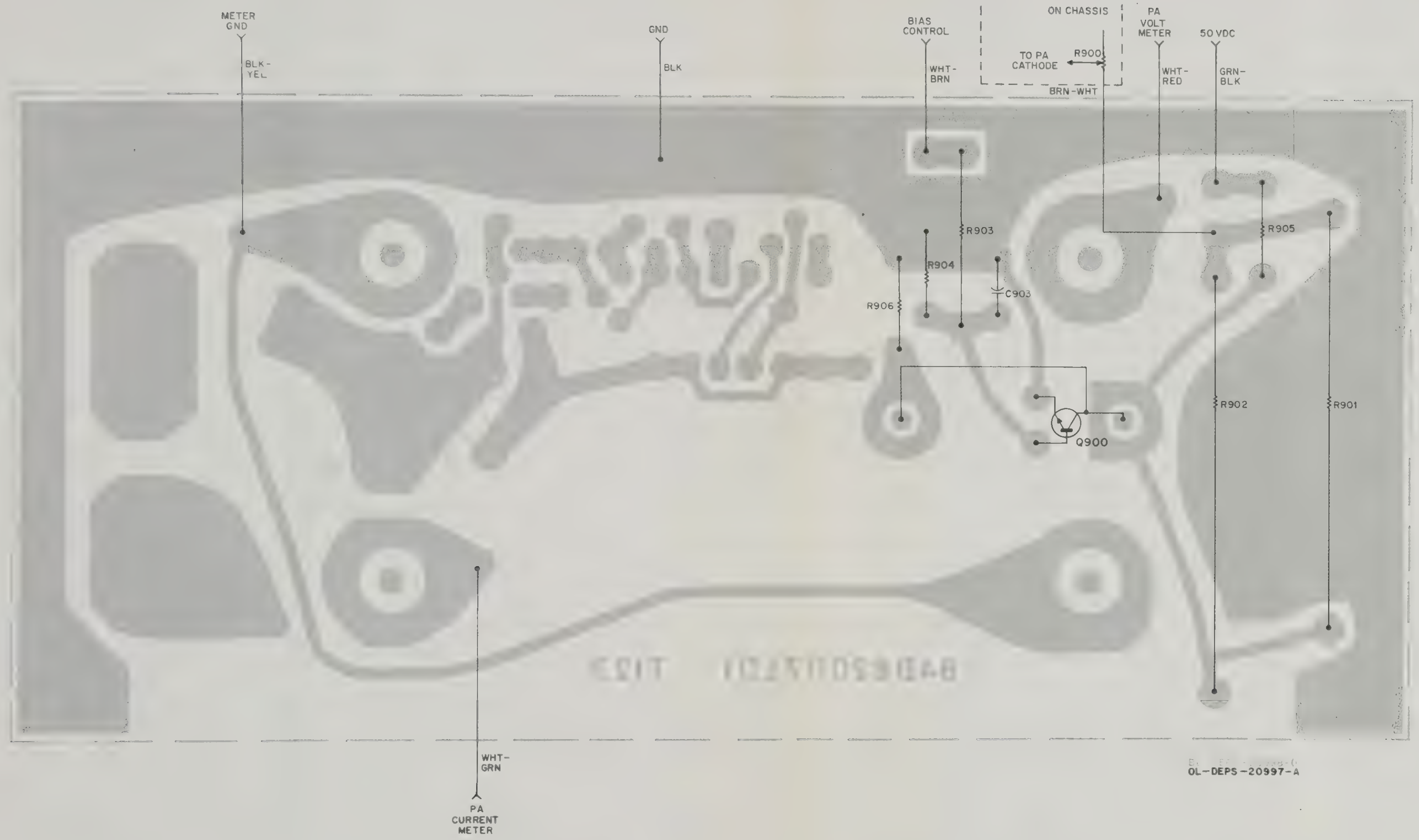
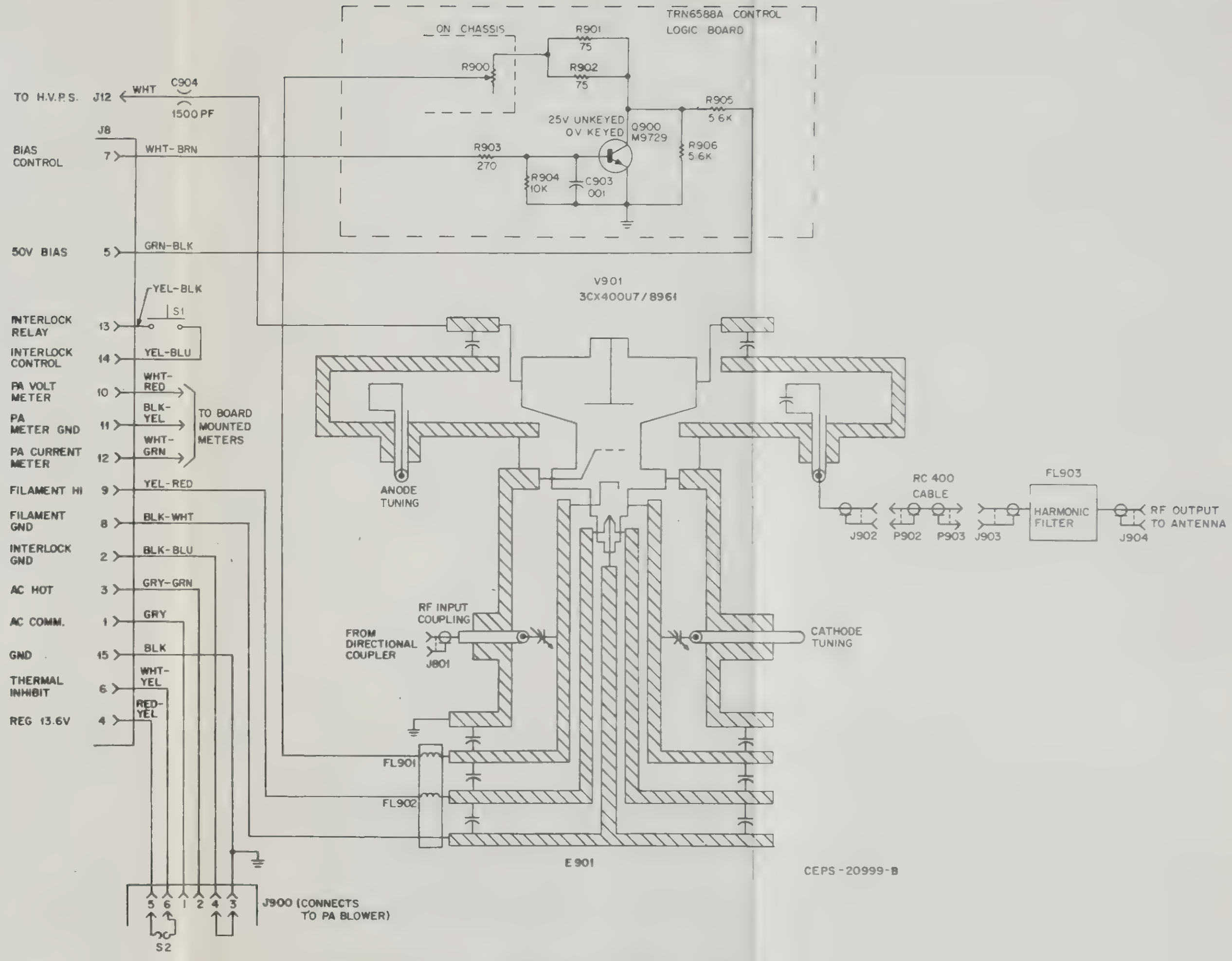

METER GND
BLK-YEL
GND
BLK
BIAS CONTROL
WHT-BRN
ON CHASSIS
TO PA CATHODE
R900
BRN-WHT
PA VOLT METER
WHT-RED
50 VDC
GRN-BLK
R903
R904
R906
C903
R905
Q900
R902
R901
WHT-GRN
PA CURRENT METER
OL-DEPS-20997-A


TRN6588A CONTROL LOGIC BOARD
ON CHASSIS
R900
R901 75
R902 75
R905 5.6K
R906 5.6K
25V UNKEYED
0V KEYED
Q900 M9729
R903 270
R904 10K
C903 .001
TO H.V.P.S. J12
WHT
C904 1500 PF
J8
BIAS CONTROL 7
WHT-BRN
50V BIAS 5
GRN-BLK
YEL-BLK
S1
INTERLOCK RELAY 13
INTERLOCK CONTROL 14
YEL-BLU
PA VOLT METER 10
WHT-RED
PA METER GND 11
BLK-YEL
PA CURRENT METER 12
WHT-GRN
TO BOARD MOUNTED METERS
FILAMENT HI 9
YEL-RED
FILAMENT GND 8
BLK-WHT
INTERLOCK GND 2
BLK-BLU
AC HOT 3
GRY-GRN
AC COMM. 1
GRY
GND 15
BLK
THERMAL INHIBIT 6
WHT-YEL
REG 13.6V 4
RED-YEL
V901
3CX400U7/8961
ANODE TUNING
RF INPUT COUPLING
FROM DIRECTIONAL COUPLER
J801
CATHODE TUNING
FL901
FL902
E901
RC 400 CABLE
FL903
HARMONIC FILTER
RF OUTPUT TO ANTENNA
J902
P902
P903
J903
J904
5 6 1 2 4 3
J900 (CONNECTS TO PA BLOWER)
S2
CEPS-20999-B

Model Table

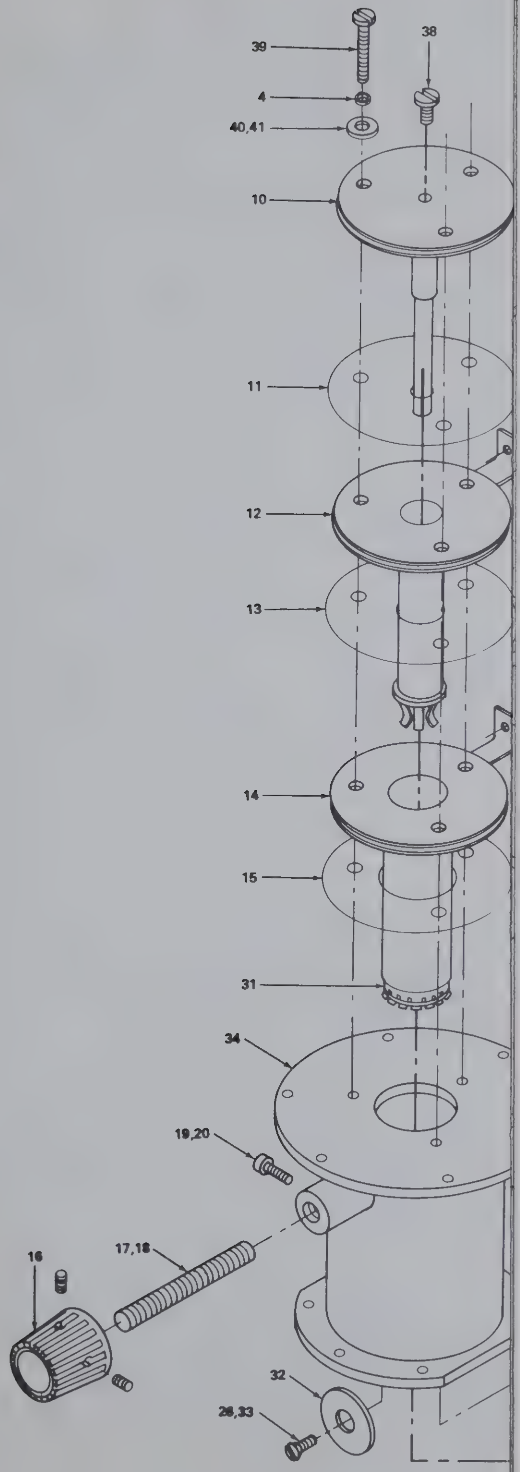
Model	Sub-Model	Suffix	Description
TLF1222A	TKN6835A		Transmitter Cable
	TLF6472A		Amplifier Cavity
	TRN4850A		Chassis & Hardware Kit
	TRN6588A		Control Logic Board
TRN6729A			Blower Kit
TRN6572A			Antenna Relay Kit

PARTS LISTS SHOWN ON
BACK OF THIS DIAGRAM

TLF1222A Final Power Amplifier
Schematic Diagram and Circuit Board Detail
Motorola No. ***PEPS-35507-O***
12/1/82- UP

TLF1222A Final Power Amplifier Mechanical Parts List PL-8313-O

ITEM	MOTOROLA PART NO.	DESCRIPTION
1	1-82479N01	TUNING ASSY.-R.H.
2	54-82479N02	LABEL, tuning
3	—	SCREW, machine: 4-40 × 5/16"; 28 used
4	4-8442	LOCKWASHER, #4 split; 45 used
5	1-82479N03	SIDE BAR ASSY.; 2 used
6	54-82479N04	LABEL, output
7	3-1237	SCREW, machine: 4-40 × 1/4"; 12 used
8	1-82479N04	OUTPUT CONNECTOR ASSY.
9	1-82479N05	TUNING ASSY.-L.H.
10	39-82479N06	CONTACT ASSY., heater
11	14-82479N07	INSULATOR, inner heater (dielectric)
12	39-82479N08	CONTACT ASSY., outer heater
13	14-82479N09	INSULATOR, outer heater (dielectric)
14	38-82479N10	CONTACT ASSY., cathode collet
15	14-82479N11	INSULATOR, cathode (dielectric)
16	36-82479N12	KNOB, control
17	3-82479N13	SCREW, probe
18	11-82479N14	LUBRIPLATE (930 AA), as required
19	3-1587	SCREW, machine: 6-32 × 5/16"
20	4-82418B03	WASHER, insulating; 1/12 used
21	64-82479N15	GRID PANEL ASSY.
22	64-82479N16	PANEL, anode
23	3-1534	SCREW, machine: 4-40 × 7/16"; 6 used
24	42-872479N17	CLAMP, ring-anode
25	14-82479N18	INSULATOR, anode (dielectric)
26	3-1938	SCREW, machine: 4-40 × 1/4"; 6 used
27	1-82479N19	GRID COLLET ASSY.
28	14-82479N20	WASHER, insulating
29	1-82479N21	ANODE COLLET ASSY.
30	54-82479N22	LABEL, high voltage
31	42-82479N23	SPRING, cathode collet
32	49-82479N24	DISK, probe; 2 used
33	11-82479N25	LOCTITE, grade CV; as required
34	15-82479N26	HOUSING ASSY.
35	58-82479N27	SLIDING PROBE ASSY.
36	42-82479N28	CLAMP, hose
37	54-82479N29	LABEL, coupling
38	3-8031	SCREW, machine: 6-32 × 1/4"; 3 used
39	3-1413	SCREW, machine: 4-40 × 5/8"; 3 used
40	4-114057	WASHER, flat: #4; 3 used
41	14-82479N30	INSULATOR, screen; 9 used
42	54-82479N31	LABEL, logo
43	3-7342	SCREW, machine: 6-32 × 3/8"; 4 used
44	11-82479N32	TAPE, kapton: 13/16" long
45	97-10794A01	TUBE, transmitting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TLF1222A Final Power Amplifier
Parts Location Detail
Motorola No. PEPS-35613-O
12/1/82 UP

parts list

TKN6835A Cable Transmitter (125 Watt) PL-4378-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		connector, receptacle:
J8		includes:
	14-82834H03	INSULATOR, 15-circuit
	29-82335A01	CONTACT, male; 15 req'd.
J900		includes:
	15-10183A57	INSULATOR, 6-circuit
	29-82336A01	CONTACT, female; 6 req'd.
		mechanical parts
	29-8383C06	LUG, solderless; 2 req'd.
	42-10217A02	STRAP, cable harness

TRN4850A Chassis and Hardware Kit PL-8208-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C904	21-83289A03	1500 uF + 100-0%; 2500 V
		filter:
FL901, 902	91-87511C01	RFI
FL901	91-84013K02	low-pass
		connector & cable assy.:
J12	30-82904H01	single contact
		connector, plug:
P902	28-852527	male; single contact
P903	28-82398E02	male; single contact
		resistor, variable:
R900	18-82779L01	W.W. 300; 50 W
		switch, snap:
S1	40-82293F01	spst
		mechanical parts
	2-131435	NUT, 4-40 × 1/4 × 3/32"; 11 req'd.
	3-1437	SCREW, machine: 4-40 × 5/8"; 2 req'd.
	3-139012	SCREW, machine: 4-40 × 1/4"; 8 req'd.
	3-134186	SCREW, tapping: 6-32 × 5/16"; 8 req'd.
	3-135111	SCREW, tapping: 4-40 × 5/8"; 13 req'd.
	3-138162	SCREW, tapping: 4-40 × 3/8"; 6 used
	4-7670	LOCKWASHER, 1/4" internal; 4 used
	5-483208	GROMMET; 6 req'd.
	7-82040L01	FRAME, filter; 2 req'd.
	7-82075L01	BRACKET, connector mounting
	14-82311L01	INSULATOR, switch
	15-82038L01	HOUSING, filter; 2 req'd.
	15-82039L01	COVER, meter
	28-817985	CONNECTOR ADAPTER, right angle
	29-5293	LUG, soldering #4L
	29-824456	LUG, tongue
	35-82310L01	SCREEN, air; 2 req'd.
	36-82632H07	KNOB, control
	42-84284B01	RETAINER; 6 used
	42-10217A02	STRAP, cable harness
	42-82041L01	CLIP, filter mounting; 2 req'd.
	42-82143C02	CLAMP, cable
	43-82350N01	SPACER, box
	43-82351N01	SPACER; 4 used
	72-84865B06	METER
	72-84865B07	METER
	64-82306L01	PLATE, PA; mounting
	7-82074L01	MOUNTING, fan
	3-1819	SCREW, machine; 6-32 × 3/16"
	54-84119B01	LABEL WARNING
	75-82471N01	BUMPER NEO.; 4 used
	1-80708D74	HOUSING, PA terminal incl. ref. part FL901, 902
	15-82302L01	HOUSING, PA
	1-80708D75	COVER, PA terminal
	15-82355H01	CAP, tube (V901)
	15-82307L01	COVER, PA
	3-138162	SCREW, tapping; 4-40 × 3/8"
	3-82227A01	SCREW, special; 6 req'd.
	3-134293	SETSCREW; 10-32 × 1/4"
	30-84173E01	CABLE, coaxial: double-shielded; 11" req'd.

TRN6588A Control Logic Board PL-4381-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C903	21-82187B20	.001 uF ± 10%, 100 V
		transistor: (see note)
Q900	48-869729	NPN; type M9729
		resistor, fixed:
R901, 902	17-82177B29	75 ± 10%; 7 W
R903	6-126C35	270 ± 10%; 1 W
R904	6-124A73	10k ± 5%; 1/4 W
R905, 906	6-124C67	5.6k ± 10%; 1/4 W
		mechanical parts
	2-7005	NUT, 6-32 × 1/4 × 3/32"; 2 req'd.
	3-7229	SCREW, machine; 6-32 × 3/8"; 2 req'd.
	4-852212 •	WASHER, insulator; 2 req'd.
	4-7650	WASHER, #6; 2 req'd.

TRN6729A Blower Kit PL-4385-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		switch:
S2	40-82585L01	rotary, momentary
		mechanical parts
	3-136138	SCREW, tapping; 6-32 × 3/8"; 5 req'd.
	3-138806	SCREW, machine; 8-32 × 5/16"; 8 req'd.
	15-10183A56	INSULATOR, connector: 6-circuit
	29-82335A01	CONTACT, male; 6 req'd.
	42-83123F01	RETAINER, 5 req'd.
	59-82076L01	MOTOR, blower
	43-82548L01	SPACER
	3-8022	SCREW, machine; 4-40 × 1/4"
	3-136523	SCREW, machine; 4-40 × 7/8"; 2 used
	4-7667	LOCKWASHER #4 external; 3 req'd.
	15-84504M01	SHROUD
	35-84502M01	AIR VANE
	42-84501M01	SPRING CLIP
	64-84503M01	PLATE, switch mount

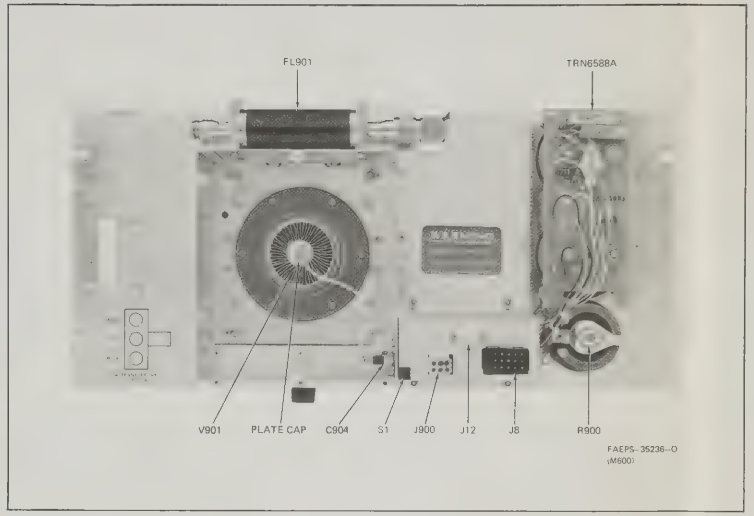
TLF6472A Amplifier Cavity PL-8213-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		cavity:
E901	1-82367N02	amplifier; assembly includes V901
		tube, electron:
V901	97-10794A01	3CX400U7/8961

TRN6572A Antenna Relay Kit (Base Station Only) PL-4434-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Field servicing of this unit is not recommended. Order entire unit for replacement.

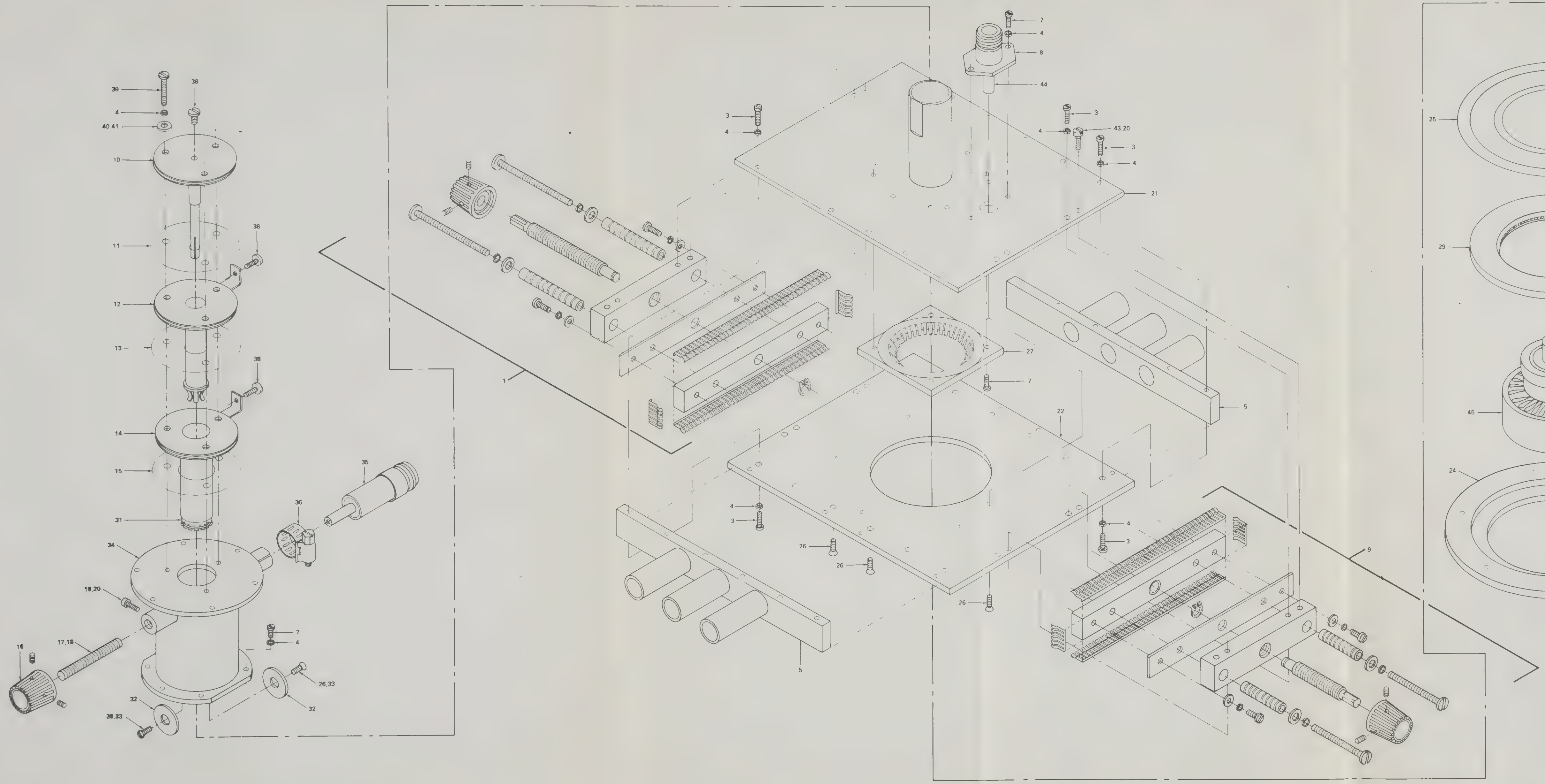
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



PA Rear View Component Identification

TLF1222A Final Power Amplifier Mechanical Parts List PL-8313-O

ITEM	MOTOROLA PART NO.	DESCRIPTION
1	1-82479N01	TUNING ASSY.-R.H.
2	54-82479N02	LABEL, tuning
3	—	SCREW, machine: 4-40 × 5/16"; 28 used
4	4-8442	LOCKWASHER, #4 split; 45 used
5	1-82479N03	SIDE BAR ASSY.; 2 used
6	54-82479N04	LABEL, output
7	3-1237	SCREW, machine: 4-40 × 1/4"; 12 used
8	1-82479N04	OUTPUT CONNECTOR ASSY.
9	1-82479N05	TUNING ASSY.-L.H.
10	39-82479N06	CONTACT ASSY., heater
11	14-82479N07	INSULATOR, inner heater (dielectric)
12	39-82479N08	CONTACT ASSY., outer heater
13	14-82479N09	INSULATOR, outer heater (dielectric)
14	38-82479N10	CONTACT ASSY., cathode collet
15	14-82479N11	INSULATOR, cathode (dielectric)
16	36-82479N12	KNOB, control
17	3-82479N13	SCREW, probe
18	11-82479N14	LUBRIPLATE (930 AA), as required
19	3-1587	SCREW, machine: 6-32 × 5/16"
20	4-82418B03	WASHER, insulating; 1/12 used
21	64-82479N15	GRID PANEL ASSY.
22	64-82479N16	PANEL, anode
23	3-1534	SCREW, machine: 4-40 × 7/16"; 6 used
24	42-872479N17	CLAMP, ring-anode
25	14-82479N18	INSULATOR, anode (dielectric)
26	3-1938	SCREW, machine: 4-40 × 1/4"; 6 used
27	1-82479N19	GRID COLLET ASSY.
28	14-82479N20	WASHER, insulating
29	1-82479N21	ANODE COLLET ASSY.
30	54-82479N22	LABEL, high voltage
31	42-82479N23	SPRING, cathode collet
32	49-82479N24	DISK, probe; 2 used
33	11-82479N25	LOCTITE, grade CV; as required
34	15-82479N26	HOUSING ASSY.
35	58-82479N27	SLIDING PROBE ASSY.
36	42-82479N28	CLAMP, hose
37	54-82479N29	LABEL, coupling
38	3-8031	SCREW, machine: 6-32 × 1/4"; 3 used
39	3-1413	SCREW, machine: 4-40 × 5/8"; 3 used
40	4-114057	WASHER, flat: #4; 3 used
41	14-82479N30	INSULATOR, screen; 9 used
42	54-82479N31	LABEL, logo
43	3-7342	SCREW, machine: 6-32 × 3/8"; 4 used
44	11-82479N32	TAPE, kapton: 13/16" long
45	97-10794A01	TUBE, transmitting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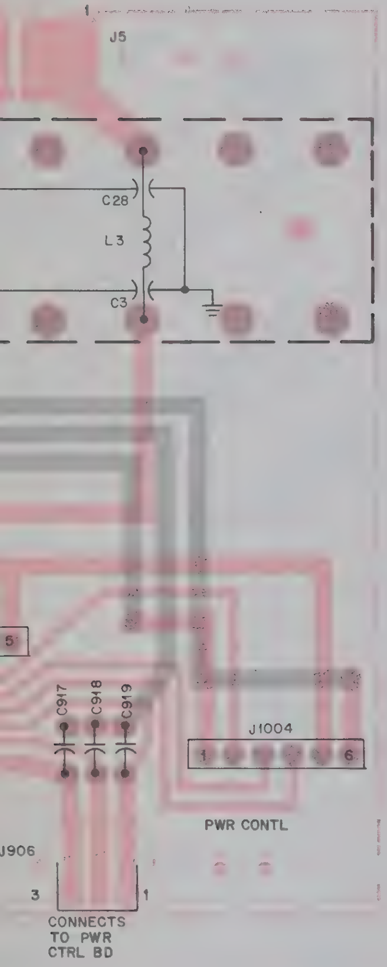
TLF1222A Final Power Amplifier
Parts Location Detail
Motorola No. PEPS-35613-O
12/1/82 UP

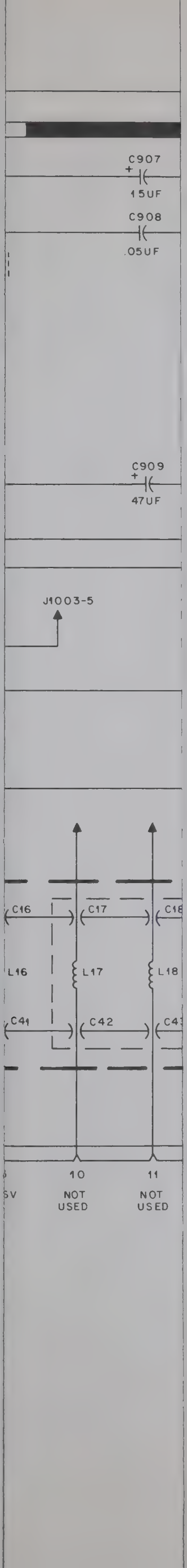


parts list

TRN5034A Transmitter Interconnect Board PL-8212-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1 thru 18	21-861219	1000 pF + 100-0%; 500 V
C19	21-82812H01	100 pF ± 10%; 500 V
C20 thru 43	21-861219	1000 pF + 100-0%; 500 V
C44 thru 50	21-82812H01	100 pF ± 10%; 500 V
C901 thru 904	21-82372C02	0.2 uF + 80-20%; 25 V
C905, 906	21-82372C04	0.05 uF + 80-20%; 25 V
C907	23-83214C02	15 pF ± 20%; 20 V
C908	21-82372C04	0.05 uF + 80-20%; 25 V
C909	23-82783B31	47 pF ± 20%; 20 V
C910	21-82372C04	0.05 uF + 80-20%; 25 V
C911, 912		NOT USED
C913, 914	21-82204B06	100 pF ± 10%; N1500
C915, 916		NOT USED
C917, 918, 919	21-82187B07	470 pF ± 10%; 500 V
C920	23-83214C20	10 uF ± 20%; 20 V
C921, 922	21-82372C04	0.05 uF + 80-20%; 25 V
		diode: (see note)
CR901, 902	48-82392B12	silicon
CR903	48-82466H13	silicon
		connector, receptacle:
J1000	28-83441F07	male, 6 pin, WHT
J1001	28-83441F06	male, 6 pin, RED
J1002	28-83441F04	male, 5 pin, RED
J1003	28-83441F05	male, 5 pin, WHT
J1004	28-83441F07	male, 6 pin, WHT
		coil, rf:
L1 thru 6	24-83977B01	1-1/2 turns
L7 thru 12	24-83961B01	3 turns
L13, 14	24-83977B01	1-1/2 turns
L15	24-83961B01	3 turns
L16	24-83977B01	1-1/2 turns
L17, 18	24-83961B01	3 turns
L19, 20	24-83977B01	1-1/2 turns
L21	24-83961B01	3 turns
L22	24-83977B01	1-1/2 turns
L23, 24	24-83961B01	3 turns
L25	24-83977B01	1-1/2 turns
L901 thru 904	24-80900A61	choke 0.62 uH
L905, 906, 907	24-83961B01	3 turns
L909	24-83961B01	3 turns
L908	24-854314	choke 33 uH
L910, 911	24-82723H01	choke, 1.2 uH
		transistor: (see note)
Q901	48-869640	type M9640
Q902	48-869701	type M9701
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R901	6-124C97	100k
R902 thru 905	6-124C73	10k
R906	6-124C49	1k
R908	17-82291B21	100 ± 5%; 3 W
R910	6-124A03	12 ± 5%
R911	6-124C49	1k
	non-referenced items	
	14-82621K01	INSULATOR
	3-134169	SCREW, tapping: 4-40 x 1/4" Phillips, hex head
	3-139495	SCREW, tapping: 4-40 x 5/16" Phillips; 4 used
	5-84220B01	GROMMET
	14-83375K01	INSULATOR
	42-83629G01	FASTENER, driver; 2 used
	1-80775B71	FILTER BRACKET ASSY.
	1-80775B75	FILTER BRACKET COVER
	14-82613M01	INSULATOR

note: Replacement diodes and transistors must be ordered by Motorola part number only for optimum perfomance.


C907
+
15UF
C908
.05UF
C909
+
47UF
J1003-5
C16
C17
L16
L17
L18
C41
C42
10
11
NOT USED
NOT USED

TRANSMITTER INTERCONNECT BOARD

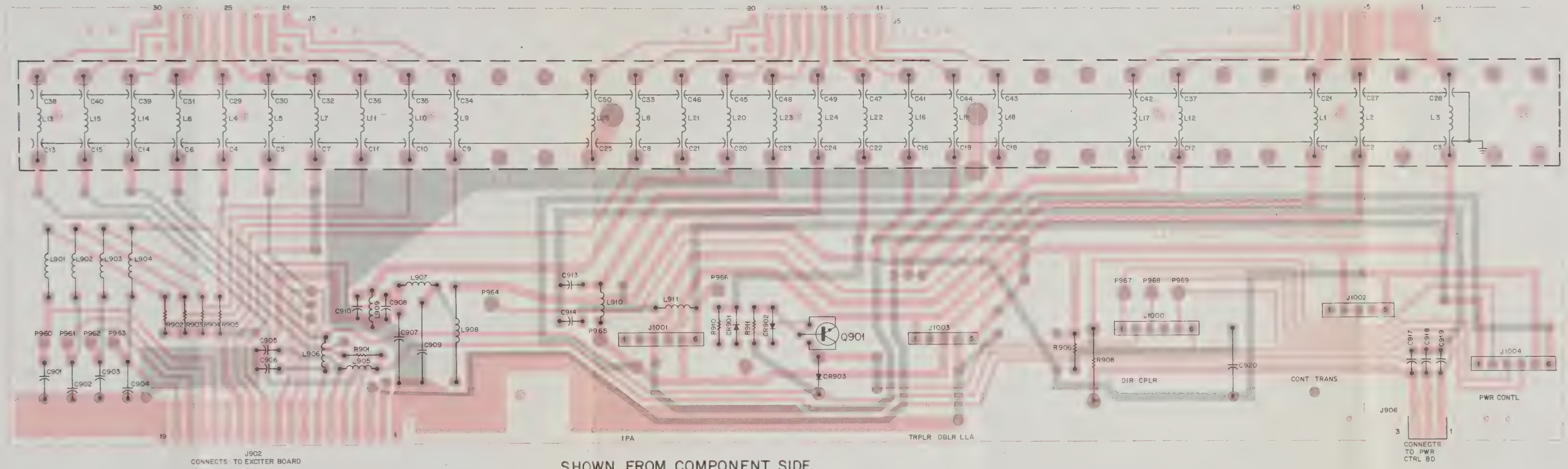
MODEL TRN5034A

FUNCTION

- Interconnects most transmitter circuit boards to each other (except PA).
- Routes control functions from the unified chassis interconnect board to the transmitter.
- Includes partial control stage circuitry used to govern PA power output.
- Includes current limiter stage which is electrically functional with antenna network.

TRANSMITTER INTERCONNECT BOARD
MODEL TRN5034A

J5 CONNECTS TO UNIFIED CHASSIS INTERCONNECT BD


30
25
21
J5
20
15
11
10
5
1
C38
C40
C39
C31
C29
C30
C32
C36
C35
C34
C50
C33
C46
C45
C48
C49
C47
C41
C44
C43
C42
C37
C26
C27
C28
L13
L15
L14
L8
L4
L5
L7
L11
L10
L9
L25
L6
L21
L20
L23
L24
L22
L16
L18
L17
L12
L1
L2
L3
C13
C15
C14
C6
C4
C5
C7
C11
C10
C9
C25
C8
C21
C20
C23
C24
C22
C16
C19
C18
C17
C12
C1
C2
C3
L901
L902
L903
L904
P960
P961
P962
P963
C901
C902
C903
C904
R902
R903
R904
R905
C905
C906
L906
R901
L905
L907
C910
C908
C907
C909
L908
P964
C913
C914
L910
L911
P965
J1001
P966
R910
CR901
R911
CR902
Q901
CR903
J1003
P967
P968
P969
J1000
J1002
R906
R908
C920
C917
C918
C919
J1004
DIR CPLR
CONT TRANS
PWR CONTL
J906
3
1
CONNECTS TO PWR CTRL BD
19
J902
CONNECTS TO EXCITER BOARD
4
IPA
TRPLR DBLR LLA

SHOWN FROM COMPONENT SIDE

SOLDER SIDE ▨ BD-EEPS-35360-0
COMPONENT SIDE 🟥 BD-EEPS-35361-0
OL-EEPS-35362-0

parts list

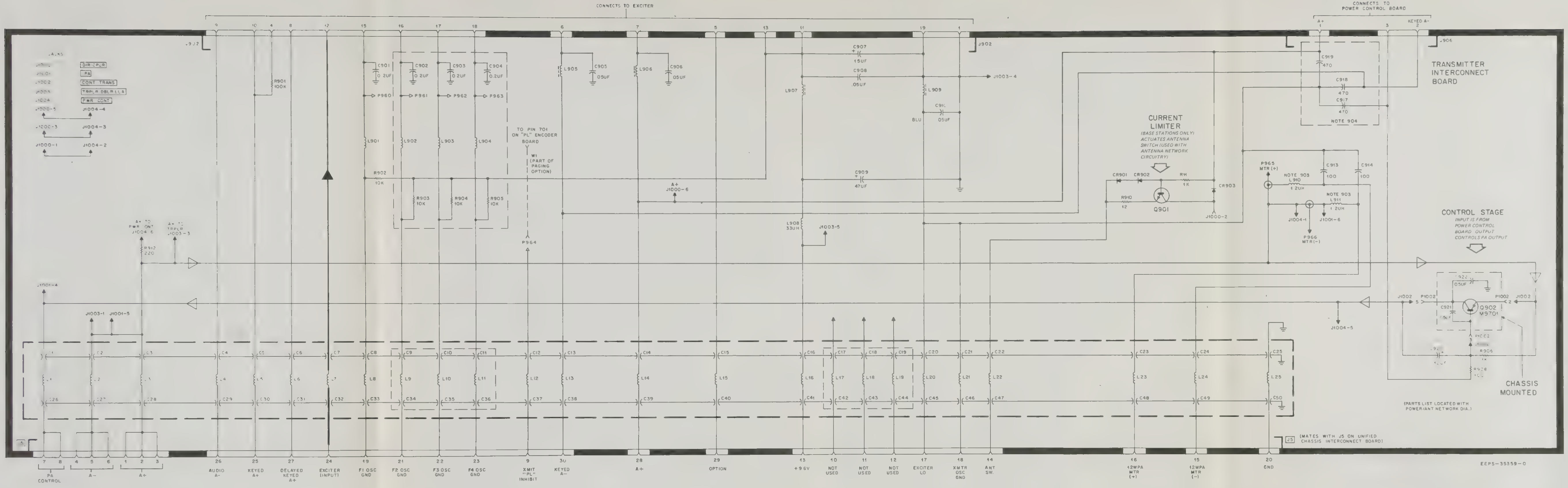
TRN5034A Transmitter Interconnect Board PL-8212-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1 thru 18	21-861219	1000 pF + 100-0%, 500 V
C19	21-82812H01	100 pF ± 10%; 500 V
C20 thru 43	21-861219	1000 pF + 100-0%; 500 V
C44 thru 50	21-82812H01	100 pF ± 10%; 500 V
C901 thru 904	21-82372C02	0.2 uF + 80-20%; 25 V
C905, 906	21-82372C04	0.05 uF + 80-20%; 25 V
C907	23-83214C02	15 pF ± 20%; 20 V
C908	21-82372C04	0.05 uF + 80-20%; 25 V
C909	23-82783B31	47 pF ± 20%; 20 V
C910	21-82372C04	0.05 uF + 80-20%; 25 V
C911, 912		NOT USED
C913, 914	21-82204B06	100 pF ± 10%; N1500
C915, 916		NOT USED
C917, 918, 919	21-82187B07	470 pF ± 10%, 500 V
C920	23-83214C20	10 uF ± 20%; 20 V
C921, 922	21-82372C04	0.05 uF + 80-20%; 25 V
		diode: (see note)
CR901, 902	48-82392B12	silicon
CR903	48-82466H13	silicon
		connector, receptacle:
J1000	28-83441F07	male, 6 pin, WHT
J1001	28-83441F06	male, 6 pin, RED
J1002	28-83441F04	male, 5 pin, RED
J1003	28-83441F05	male, 5 pin, WHT
J1004	28-83441F07	male, 6 pin, WHT
		coil, rf:
L1 thru 6	24-83977B01	1-1/2 turns
L7 thru 12	24-83961B01	3 turns
L13, 14	24-83977B01	1-1/2 turns
L15	24-83961B01	3 turns
L16	24-83977B01	1-1/2 turns
L17, 18	24-83961B01	3 turns
L19, 20	24-83977B01	1-1/2 turns
L21	24-83961B01	3 turns
L22	24-83977B01	1-1/2 turns
L23, 24	24-83961B01	3 turns
L25	24-83977B01	1-1/2 turns
L901 thru 904	24-80900A61	choke 0 62 uH
L905, 906, 907	24-83961B01	3 turns
L909	24-83961B01	3 turns
L908	24-854314	choke 33 uH
L910, 911	24-82723H01	choke, 1.2 uH
		transistor: (see note)
Q901	48-869640	type M9640
Q902	48-869701	type M9701
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R901	6-124C97	100k
R902 thru 905	6-124C73	10k
R906	6-124C49	1k
R908	17-82291B21	100 ± 5%; 3 W
R910	6-124A03	12 ± 5%
R911	6-124C49	1k
	non-referenced items	
	14-82621K01	INSULATOR
	3-134169	SCREW, tapping: 4-40 x 1/4" Phillips, hex head
	3-139495	SCREW, tapping: 4-40 x 5/16" Phillips; 4 used
	5-84220B01	GROMMET
	14-83375K01	INSULATOR
	42-83629G01	FASTENER, driver; 2 used
	1-80775B71	FILTER BRACKET ASSY.
	1-80775B75	FILTER BRACKET COVER
	14-82613M01	INSULATOR

note: Replacement diodes and transistors must be ordered by Motorola part number only for optimum perfomance.

Motorola No. PEPS-35508-O
(Sheet 1 of 2)
12/1/82- UP

TRANSMITTER INTERCONNECT BOARD
MODEL TRN5034A


CONNECTS TO EXCITER
CONNECTS TO POWER CONTROL BOARD
A+
KEYED A-
J907
J902
J906
TRANSMITTER INTERCONNECT BOARD
C919 470
C918 470
C917 470
NOTE 904
C907 15UF
C908 05UF
L909
C911 05UF
L907
R901 100K
C901 0.2UF
C902 0.2UF
C903 0.2UF
C904 0.2UF
P960
P961
P962
P963
L905
C905 05UF
L906
C906 05UF
L901
L902
L903
L904
R902 10K
R903 10K
R904 10K
R905 10K
TO PIN 701 ON "PL" ENCODER BOARD
W1 (PART OF PAGING OPTION)
P964
A+ J1000-6
C909 47UF
L908 53UH
J1003-5
J1003-4
CURRENT LIMITER
(BASE STATIONS ONLY) ACTUATES ANTENNA SWITCH (USED WITH ANTENNA NETWORK CIRCUITRY)
CR901
CR902
R11 1K
CR903
R910 12
Q901
J1000-2
P965 MTR (+)
NOTE 903 L910 1 2UH
C913 100
C914 100
NOTE 903 L911 1 2UH
J1004-1
J1001-6
P966 MTR (-)
CONTROL STAGE
INPUT IS FROM POWER CONTROL BOARD OUTPUT CONTROLS PA OUTPUT
J1002
P1002
Q902 M9701
J1003
J1004-5
CHASSIS MOUNTED
(PARTS LIST LOCATED WITH POWER/ANT NETWORK DIA.)
A+ TO PWR CNT J1004-6
A+ TO TRPLR J1003-3
R912 220
J1001-4
J1003-1
J1001-5
J1002-3
J1004-3
J1000-1
J1004-2
J1004-4
DIR CPLR
PA
CONT TRANS
TRPLR DBLR
PWR CONT
J5 (MATES WITH J5 ON UNIFIED CHASSIS INTERCONNECT BOARD)
7 8 PA CONTROL
4 5 6 A-
1 2 3 A+
26 AUDIO A-
25 KEYED A+
27 DELAYED KEYED A+
24 EXCITER (INPUT)
19 F1 OSC GND
21 F2 OSC GND
22 F3 OSC GND
23 F4 OSC GND
9 XMIT "PL" INHIBIT
30 KEYED A-
28 A+
29 OPTION
13 +9 6V
10 NOT USED
11 NOT USED
12 NOT USED
17 EXCITER LO
18 XMTR OSC GND
14 ANT SW.
16 12WPA MTR (+)
15 12WPA MTR (-)
20 GND
EEPS-35359-0

NOTES

901 UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN PICOFARADS.

902 FILTERING CHOKES AND BYPASS CAPACITORS ARE USED ON VOLTAGE AND GROUND RUNS TO PREVENT RF RADIATION FROM BEING CONDUCTED TO THE UNIFIED CHASSIS INTERCONNECT BOARD AND AFFECTING STATION OPERATION

903 FILTERING CHOKES L910 AND L911 (FUNCTIONAL WITH 12 WATT STATIONS ONLY) PROVIDE FILTERING FOR BUILT IN STATION METERING

904 CAPACITORS C917, C918 AND C919 SHUNT RF ENERGY ON THE A+, KEYED A - AND POWER CONTROL LEADS TO GROUND.

LEGEND

⇨ = THEORY OF OPERATION DATA
▶ = PRIMARY SIGNAL FLOW
▷ = SECONDARY SIGNAL FLOW

FUNCTION

- Interconnects most transmitter circuit boards to each other (except PA).
- Routes control functions from the unified chassis interconnect board to the transmitter.
- Includes partial control stage circuitry used to govern PA power output.
- Includes current limiter stage which is electrically functional with antenna network.

Motorola No. PEPS-35508-O
(Sheet 2 of 2)
12-1/82-UP

TRANSMITTER INTERCONNECT BOARD

MOTOROLA INC.
Communications
Sector

MICOR SENSITRON RECEIVER RF AND I-F BOARD

MODEL TRF1032A
900 MHz

1. INTRODUCTION

This section contains specific theory of operation, maintenance, and troubleshooting information on the receiver rf and i-f deck.

2. RECEIVER RF AND I-F DECK FUNCTIONAL DESCRIPTION

2.1 RF INJECTION STRING

2.1.1 Oscillator (Channel Element)

Channel elements are temperature compensated, crystal controlled oscillators (TCXO), operable over the temperature range of −30° to +60°C (−22° to +140°F). A variable warp capacitor, located in the base of the oscillator, is provided for increased accuracy. Channel elements are factory sealed plug-in modules and should not be field serviced.

2.1.2 Multipliers

The third harmonic of the channel element is selected by a two cell LC tuned circuit. The signal is then multiplied 16 times by two doubler circuits and a double doubler circuit and applied to the two cell preselector of the first mixer.

2.2 RF PRESELECTOR

RF preselector selectivity prevents receiver degradation from mixer image frequency and spurious harmonics. It consists of five low loss, highly selective helical resonant cavities. The bandpass of the preselector is characterized by a flat acceptance bandwidth and a steep skirt response. Carrier signals received at the antenna are routed through the preselector for cavities to the mixer stage to be heterodyned with the injection frequency.

2.3 FIRST MIXER

The first mixer heterodynes the rf signal from the injection string with the carrier signal from the preselector, producing a high i-f of 45 MHz. Frequency relationships are as follows:

$$f_c = 48f_o + 45\text{ MHz}$$

Where: f_c = carrier frequency
f_o = channel element fundamental

2.4 DOUBLE-POLE CRYSTAL FILTER

The double-pole crystal filter accepts the high i-f of 45 MHz and attenuates signals outside the bandwidth. It increases receiver selectivity and couples the high i-f to the second mixer.

2.5 SECOND MIXER

The second mixer uses a field effect transistor with low noise level and high conversion gain to heterodyne the high i-f with a second oscillator frequency, producing a low i-f of 11.7 MHz. Frequency relationships are expressed as follows:

$$45\text{ MHz} = f_o + 11.7\text{ MHz}$$

Where f_o = second oscillator frequency

2.6 SECOND OSCILLATOR AND BUFFER

The second oscillator is a crystal controlled, tunable oscillator. It employs a buffer output to prevent load variations from degrading the generated signal and filtering to reduce spurious harmonics.

2.7 FIRST FOUR-POLE CRYSTAL FILTER

This filter and the second four-pole crystal filter are the major factors determining final receiver bandwidth and selectivity.

The first four-pole crystal filter consists of two monolithic crystals and associated impedance matching circuitry. The output of the mixer is coupled to the input of the filter by an adjustable matching network.

Each crystal produces mechanical vibrations at the crystal input when the electrical i-f signal is applied. Due to the inherent piezoelectric property of quartz crystals, these vibrations are propagated throughout the crystal and reconverted to electrical signals at the output electrodes. The high "Q" of the crystals creates a narrow bandpass resulting in excellent off-channel signal rejection.

2.8 FIRST I-F AMPLIFIER

The first i-f amplifier couples signals between the first and second four-pole crystal filters and provides approximately 70 dB gain. The integrated circuit (U601) contains three differential amplifier stages that are internally voltage regulated and temperature compensated. Isolation between the three stages is provided internally.

2.9 SECOND FOUR-POLE CRYSTAL FILTER

The second four-pole crystal filter establishes final receiver selectivity and operates identically to the first four-pole crystal filter previously described. The filter signal is applied to the second i-f amplifier.

2.10 SECOND I-F AMPLIFIER AND LIMITER

The second i-f amplifier and limiter consists of integrated circuit (U602) and with associated discrete components performs amplification and limiting functions.

Four differential amplifiers with internal voltage regulation and temperature compensation are employed. The first two differential amplifiers provide approximately 55 dB gain. The second stage output provides metering and is applied to the third stage. The third stage, along with the fourth stage, becomes overdriven to provide excellent symmetrical limiting characteristics. Full limiting occurs regardless of signal strength.

The limited output of the second i-f amplifier is applied to the discriminator. Since amplitude has now been made constant, the discriminator, which normally would respond to both amplitude and frequency variations produces true frequency demodulation.

3. MAINTENANCE

3.1 INTRODUCTION

This section provides maintenance procedures for the receiver rf and i-f board. These procedures consist of tests which include metering measurements and testing and troubleshooting procedures that includes integrated circuit checks.

> **NOTE**
>
> The receiver rf and i-f board must be installed in a receiver chassis for testing to provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stages of the receiver.

3.2 PERFORMANCE TESTS

3.2.1 General

Use the following tests to determine if the receiver rf and i-f board is operating properly. If testing produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart (diagram DEPS-35320).

3.2.2 No-Signal Meter Reading Test

A failure in any part of the rf and i-f board will usually result in improper meter readings at one or more test positions. Perform checks at meter position 1 through 5 and compare the results with values shown in Table 1.

Table 1. Minimum Receiver RF & I-F Meter Readings (No Input Signal Applied)

Selector Switch Position	Reading (Micro-Amps)	Circuit Metered
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4+, 4−	0 ±2	Discriminator Output
5	10	Second I-F Amplifier & Limiter

3.2.2.1 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver chassis for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the receiver as follows:

- Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.
- Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:

- Set the function switch to the RCVR position.
- Set the meter reversing switch to the OFF position.
- Set the adapter cable SENS switch to the 100 mV position. If the adapter cable has no SENS switch, the unit operates at 100 mV all of the time.
- Set the adapter cable reference switch to position A or position B.

Step 6. Refer to the readings in Table 1. Set the test set selector switch to the positions called for in the table and observe the test set meter. Notice that the meter readings given in the table are minimums.

3.2.2.2 Input Voltages

3.2.2.2.1 If there are no test set indications at one or more of the metered points, check the dc input voltages to the receiver rf and i-f circuit board.

P904-9	A+ continuous (+13.8 V dc with reference to chassis)
P904-11	9.6 V dc continuous (with reference to chassis) (±0.5 V)
P904-8, 6	9.6 V dc continuous (with reference to chassis) (±0.5 V)

3.2.2.2.2 If test set indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

3.2.2.3 Using Built-In Receiver Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Plug the receiver service kit into the station.

NOTE

The receiver service kit will not operate unless the TKN6759A Cable Kit has been installed in the receiver.

It is not necessary to turn the metering POWER switch on. The switch should only be in the "on" position when the METER SELECTOR switch is set on position 6.

Step 5. Refer to the meter reading table in paragraph 3.2.2. Set the meter selector switch to the positions called for in the table and observe the meter. Notice that the meter readings given in the table are minimums.

3.2.2.4 20 dB Quieting Sensitivity Test

This performance test may be used after repair and alignment to assure that the receiver meets all specifications before it is returned to service. The receiver shield must be in place while performing this test.

- Using an AC Voltmeter and Portable Test Set

Step 1. Perform Steps 1 thru 5 in paragraph 3.2.2.1.

Step 2. Connect an ac voltmeter across pins 1 and 18 of the audio control module.

Step 3. (PL receivers only.) Disable PL, using the switch on the PL module.

Step 4. Set the receiver squelch control fully counterclockwise (unsquelched).

Step 5. Adjust the LINE LEVEL control so the ac voltmeter reads 565 mV ac.

Step 6. Set the signal generator controls as follows:

- Set up the signal generator to produce a cw or unmodulated signal.
- Set the generator output level to maximum.
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until test set meter position 4 reads exactly zero.

Step 7. Slowly decrease the signal generator output level until the ac voltmeter reads 56.5 mV ac (20 dB down from 565 mV ac). Switch to a lower voltmeter scale if necessary.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 8. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less.

Step 9. Readjust the LINE LEVEL control as described in the Maintenance section of the manual.

3.2.2.5 Using Built-In Receiver Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver. Turn metering on.

Step 4. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. *Private-Line* stations must also be PL disabled.

Step 5. Set meter selector switch to POS 6 and the speaker switch to the "off" POS. Adjust the LINE LEVEL control for 50 uA as indicated on the meter.

Step 6. Connect an rf signal generator to the receiver input connector.

Step 7. Set the signal generator controls as follows:

- Set up the signal generator to produce a cw or unmodulated signal.
- Set the generator output level to maximum.
- Set the signal generator output frequency to the selected channel receive frequency. To set the signal generator on frequency without a frequency counter, adjust the generator frequency control until meter position 4 reads exactly zero.

Step 8. Slowly decrease the signal generator output level until METER POS 6 reads 5 uA.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency to zero meter 4 as the output level is reduced.

Step 9. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV or less.

Step 10. Readjust the LINE LEVEL control as described in the Maintenance section of the manual.

3.3 FIRST MIXER REPLACEMENT PROCEDURE

3.3.1 General

3.3.1.1 Extreme care must be exercised in removing the mixer substrate. It is recommended that complete troubleshooting be performed to assure that the mixer is faulty before attempting replacement. No attempt should be made to repair individual substrate components, Rather, *the mixer should be replaced as an assembly*.

3.3.1.2 Two types of soldering irons are required to remove and replace the mixer. A chisel tipped iron of 150 watt rating is needed for connections to the rf deck. A small iron of 50 watt rating is required for substrate connections.

3.3.2 Replacement Procedure

Step 1. Remove the receiver rf and i-f board from the chassis.

Step 2. Unplug the mixer output cable from the rf and i-f board and remove the screws holding the cable lugs to the rf deck.

Step 3. Remove the four hex-Phillips screws which hold the mixer cavity shield.

Step 4. Using the large iron, unsolder the ground straps from the rf deck, adding solder as necessary to insure proper heat transfer.

Step 5. Carefully unsolder the two heavy gauge wire connections leading to pads at the top edge of the mixer substrate.

CAUTION

Prolonged heat or excessive strain at these connections may result in permanent damage to the substrate and associated components.

When both leads are free, bend the leads slightly to facilitate easy removal of the substrate.

Step 6. Lift the substrate VERTICALLY out of the rf deck.

Step 7. Press the nylon guides onto the edges of the replacement mixer substrate and carefully slide the unit into the rf deck.

Step 8. Using a large, well tinned iron, solder the ground straps to the rf deck. Remove excess solder to allow the cover to fit flush over the mixer cavity.

Step 9. Bend the heavy leads to conform to the pads on the substrate. The leads must be formed so that no strain is placed on the substrate when the leads are soldered in place. Use the minimum heat necessary to insure a good solder connection.

Step 10. Replace mixer cavity cover.

3.4 DOUBLE DOUBLER REPLACEMENT PROCEDURES

3.4.1 Assembly Replacement Procedure

Step 1. Disconnect the input coaxial cable (phono connector to printed circuit board) and the output cable (coaxial cable from the injection filter).

Step 2. Disconnect the 9.6 volt supply line (orange) at the printed circuit board.

Step 3. Remove the screws which fasten the input coaxial cable to the rf deck.

Step 4. Remove the three screws which fasten the quadrupler housing to the rf deck.

Step 5. Replace the new double doubler assembly in the reverse order of the above procedure.

3.4.2 Transistor Replacement Procedure

Using a 50 watt soldering iron and silver solder (silver content 2%), perform transistor replacement as follows.

Step 1. Carefully unsolder L201, L203, and R201 at the transistor pads and bend the components away from the transistor.

Step 2. Unsolder and remove the transistor.

Step 3. Remove excess solder from the substrate solder pads.

Step 4. Place the new transistor on the substrate pads. While holding the transistor in place with a tweezers, solder the emitter lead first and then the remaining leads. Be sure the transistor leads are positioned in the center of their respective substrate pads.

Step 5. Reposition L201, L203, and R201 and resolder their leads.

Step 6. Perform double doubler testing to insure unit is properly functioning.

3.5 TROUBLESHOOTING

3.5.1 Visual Inspection

3.5.1.1 The first step in the troubleshooting procedure should be a thorough visual inspection of the receiver and, in particular, the receiver rf and i-f board. Corrosion and burned or damaged components are usually easily seen and may be the cause of a symptom of the receiver malfunction. Loose circuit board mounting screws or a loose or improperly installed receiver shield are other easily found problems that can cause a considerable degradation in receiver performance.

3.5.1.2 After the obvious problems have been corrected, repeat the receiver rf and i-f board performance tests. If the tests still produce unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart. The troubleshooting chart provides a systematic procedure for isolation of the defective stage and component.

3.5.1.3 As much information as possible has been included on the troubleshooting chart. However, you may have to refer occasionally to the receiver rf and i-f schematic diagram and circuit board detail. Detailed procedures regarding integrated circuits, troubleshooting, receiver gain measurements, and crystal dip tests follow in the text of this section of the manual.

3.5.2 Alignment as a Troubleshooting Technique

Low test set readings, improper discriminator output, and otherwise abnormal performance are very often corrected by realignment. Therefore, alignment should be one of the first troubleshooting steps performed for these symptoms.

3.5.3 Troubleshooting Integrated Circuits

3.5.3.1 Integrated circuits (ICs) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

3.5.3.2 The ICs on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in Table 2.

Table 2.
Nominal Receiver Integrated Circuit DC Voltages
(All readings are in volts dc,
measured with respect to chassis)

Pin No.	U601 Voltage	U602 Voltage
1	GND	2.8
2	GND	GND
3	2.9	2.9
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.9	2.9
9	2.9	2.9
10	GND	GND

NOTE: All voltages may vary ± 10% from nominal readings shown.

3.5.4 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every filter crystal has a good conductive path to ground. An ohmmeter test should indicate less than 1 ohm between the crystal case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure. Complete receiver rf and i-f alignment. Leave alignment test equipment connected to perform this check.

Step 2. Refer to receiver gain measurements in Table 3, the rf and i-f schematic diagram, and the rf and i-f circuit board detail.

NOTE

Receiver rf input voltages given in Table 3 are those at the receiver input connector. If a pad or other attenuator is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

Examples:

6 dB loss means V out of the pad = 1/2 V into the pad.

20 dB loss means V out of the pad = 1/10 V into the pad.

Step 3. Set the signal generator output frequency to the receiver channel frequency ("0" reading on meter 4). Adjust the signal generator output to provide the required receiver input voltage for a particular test point as listed in the table. Then, using an rf voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. When using a high impedance rf probe (see Table of Recommended Test Equipment), the measured voltage at every test point should be within ±6 dB of the value given in Table 3.

Table 3. Receiver Gain Measurements

Test Point (See rf & i-f circuit board detail)	Receiver Input Voltage (preset)	Test Point Voltage (mV) ±6 dB	Remarks
L	50 mV	180	
M	50 mV	250	
N	50 mV	600	
O	50 mV	575	
P	50 mV	550	
Q	50 mV	500	
R	50 mV	250	U601
S	50 mV	800	saturated
T	20 uV	400	output
U	20 uV	375	
V	20 uV	350	
W	20 uV	300	U602
X	20 uV	75	saturated
Y	0	1000	output

Step 4. A high or low test point voltage measurement *may* indicate that the crystal at or ahead of the test point is defective. However, it may also indicate that an associated circuit component is defective. The extremely high-Q crystals used in *Micor* radios are very sensitive to associated circuit components. For example, if L601 is defective, it might appear that Y601 is bad. To isolate the defective component, perform the crystal dip tests described in the following procedure.

3.5.5 Crystal Dip Test

3.5.5.1 A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

3.5.5.2 The monolithic crystals used in *Micor* receivers are made up of two separate resonators on a single quartz blank. Each crystal has a pair of characteristic operating frequencies. One way to find the characteristic frequencies of each crystal is to short the crystal output to chassis ground, then monitor the crystal input voltage with an rf voltmeter while varying the signal generator frequency across the bandpass of the receiver. Low voltage points will occur at each of the crystal characteristic frequencies.

3.5.5.3 Figures 1 and 2 are plots of typical rf voltmeter readings obtained while testing good crystals. Note that the horizontal scales are calibrated in frequency, with f_o the channel frequency of the receiver. The vertical scales represent *relative* rf voltmeter readings. The bottom line is zero and the top line is maximum. Notice that each plot has a sharp minimum point above f_o and another below f_o. The table of crystal dip frequencies at the end of this section lists the frequencies at which these dip points should appear. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective.

Step 1. Leave the test equipment set up as was done for the receiver gain measurements.

Step 2. Set the signal generator to f_o, the receiver channel frequency ("0" on meter 4). Adjust the generator output control for at least 50 mV *at the receiver input connector*.

Step 3. Refer to the crystal dip frequencies in Table 4. To test a particular crystal, find it in the table, ground the indicated test point, and connect an rf voltmeter between the monitored test point and a nearby chassis ground point.

Step 4. Starting at f_o, slowly increase the signal generator frequency while watching for a dip in the rf voltmeter reading. This dip should be sharp, so increase the signal generator frequency very slowly and watch the rf voltmeter closely. When the dip is found, write down the frequency counter reading.

Table 4. Crystal Dip Frequencies

Crystal	Test Point Grounded	Test Point Monitored	+ Frequency Dip (kHz) ± 2.5 kHz	− Frequency Dip (kHz) ± 2.5 kHz
Y601	O	N	4.5	9.0
Y602	Q	P	4.0	10.0
Y603	U	T	4.5	9.0
Y604	W	V	4.0	10.0

Step 5. Return the signal generator to f_o. Then watch the rf voltmeter while *slowly decreasing* the signal generator frequency. When the dip is found, write down the frequency counter reading.

Step 6. Compare your test results with the frequencies and tolerances listed in the table for the crystal you have tested. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective. Continue with this procedure to isolate the bad component.

Step 7. FOR TEST PURPOSES ONLY, exchange the suspected crystal with another from the receiver. Be sure you note the polarity of the crystal when you make the change. Repeat the receiver gain measurement and crystal dip test on the suspected crystal in the new location. If the suspected crystal tests bad again, consider it defective and replace it. If the crystal tests good, look for defective associated components at the original crystal location.

Step 8. When the tests are completed, be sure *all* jumpers connected during the test are removed and that any *moved crystals are returned to their original locations*. Refer to the parts list and circuit board detail for correct part location. Note crystal polarity when replacing crystals.

3.5.6 Double Doubler Troubleshooting

Disconnect the input coaxial cable (phono connector to printed circuit board). Test the second doubler output. If the second doubler is operating properly, reconnect the double doubler input coaxial cable to the 2nd doubler. Disconnect the double doubler output cable. Using a 50 ohm probe, rated for at least 1000 MHz, test the double doubler output voltage. A minimum reading of 70.7 millivolts should be obtained. If the minimum reading is not obtained, check the dc voltages on the schematic.

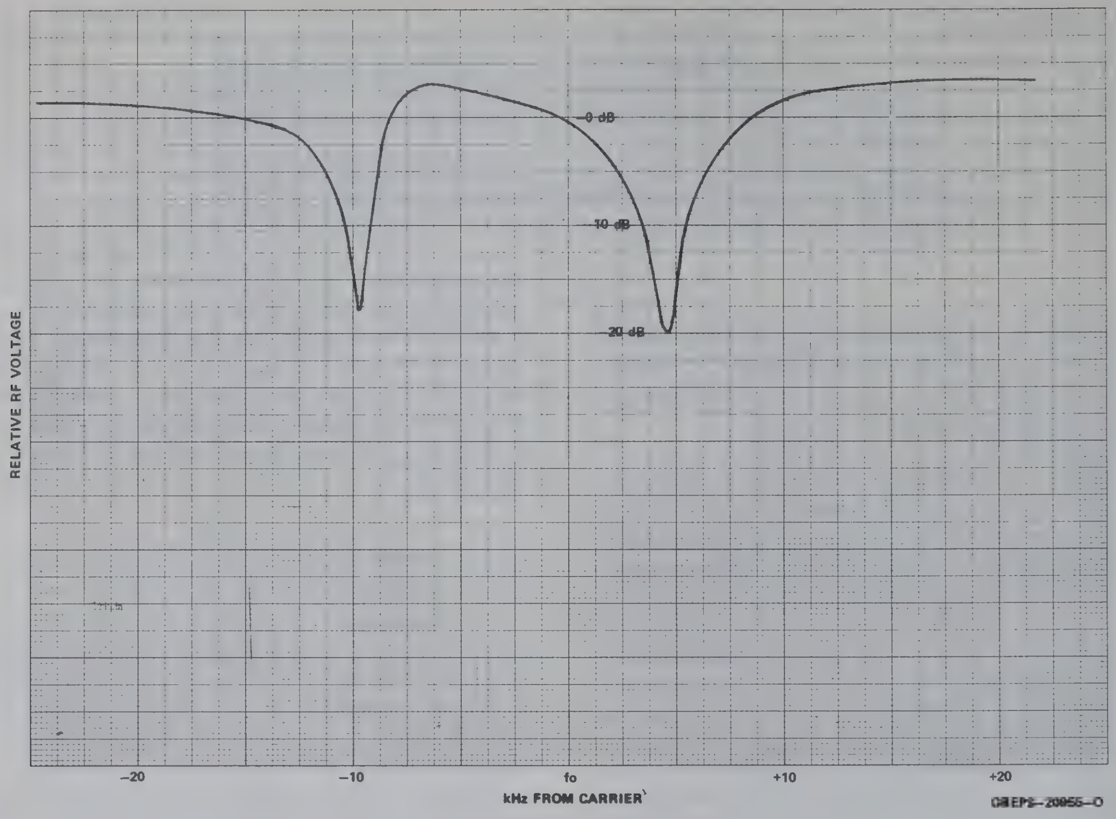


Figure 1. Typical Plot of a Known Good Crystal in Position Y601 or Y603

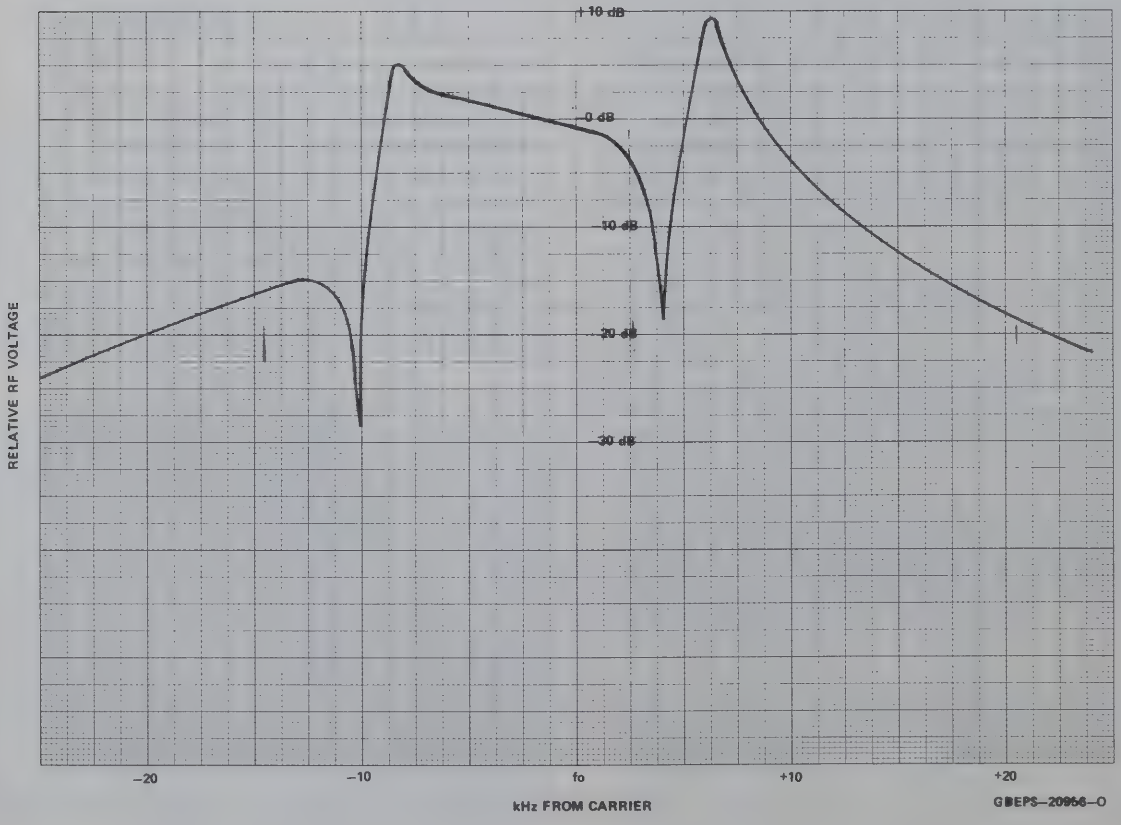


Figure 2. Typical Dip Plot of a Known Good Crystal in Position Y602 or Y604

1. CHECK SUPPLY VOLTAGE ON SECOND MIXER.
2. PERFORM SUPPLY TESTS GIVEN ON THIS CHART, TABLE II.
3. PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES.

CHECK DC VOLTAGES ON 2ND DOUBLER ACCORDING TO SCHEMATIC DIAGRAM.

TEGRATED CIRCUIT

VOLTS DC,
ECT TO CHASSIS)

U602 VOLTAGE
2.8
GND
2.8
6.6
9.3
7.2
6.4
2.8
2.8
GND

VARY +10% FROM
SHOWN.

TRF1032A RF and I-F Board
Troubleshooting Chart
Motorola No. DEPS-35320-O
12/1/82- UP

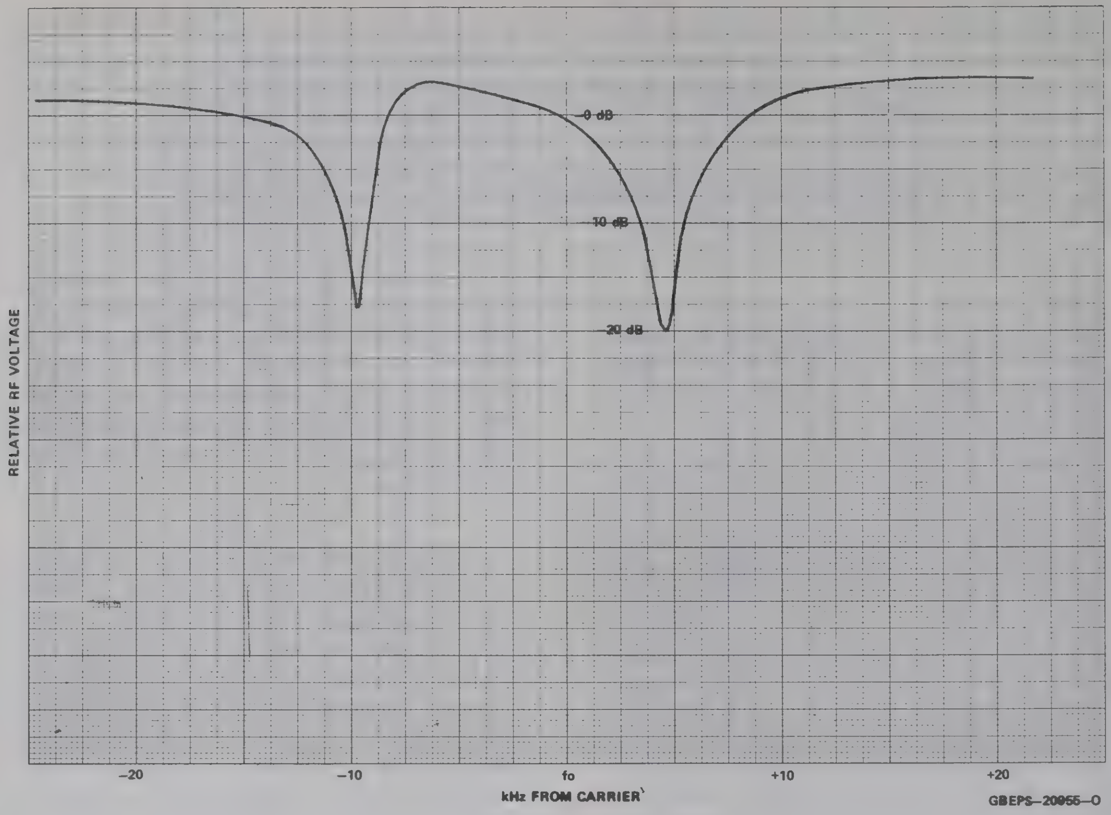


Figure 1. *Typical Plot of a Known Good Crystal in Position Y601 or Y603*

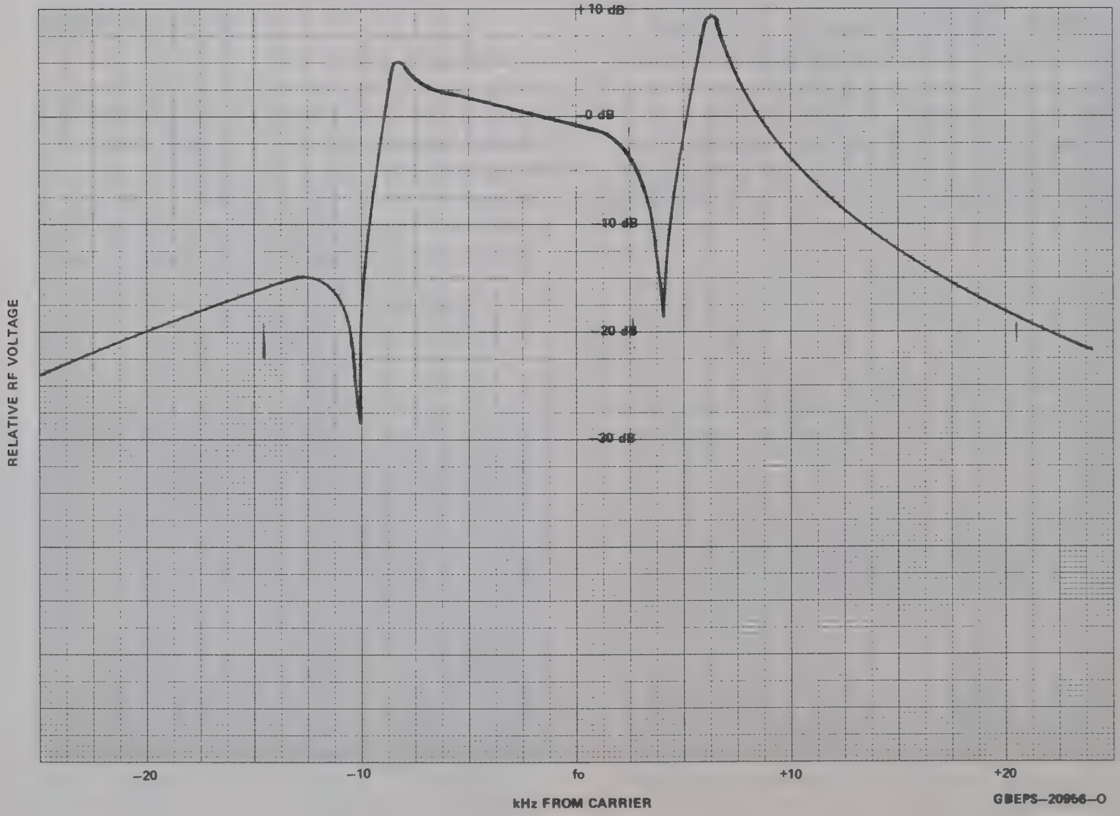
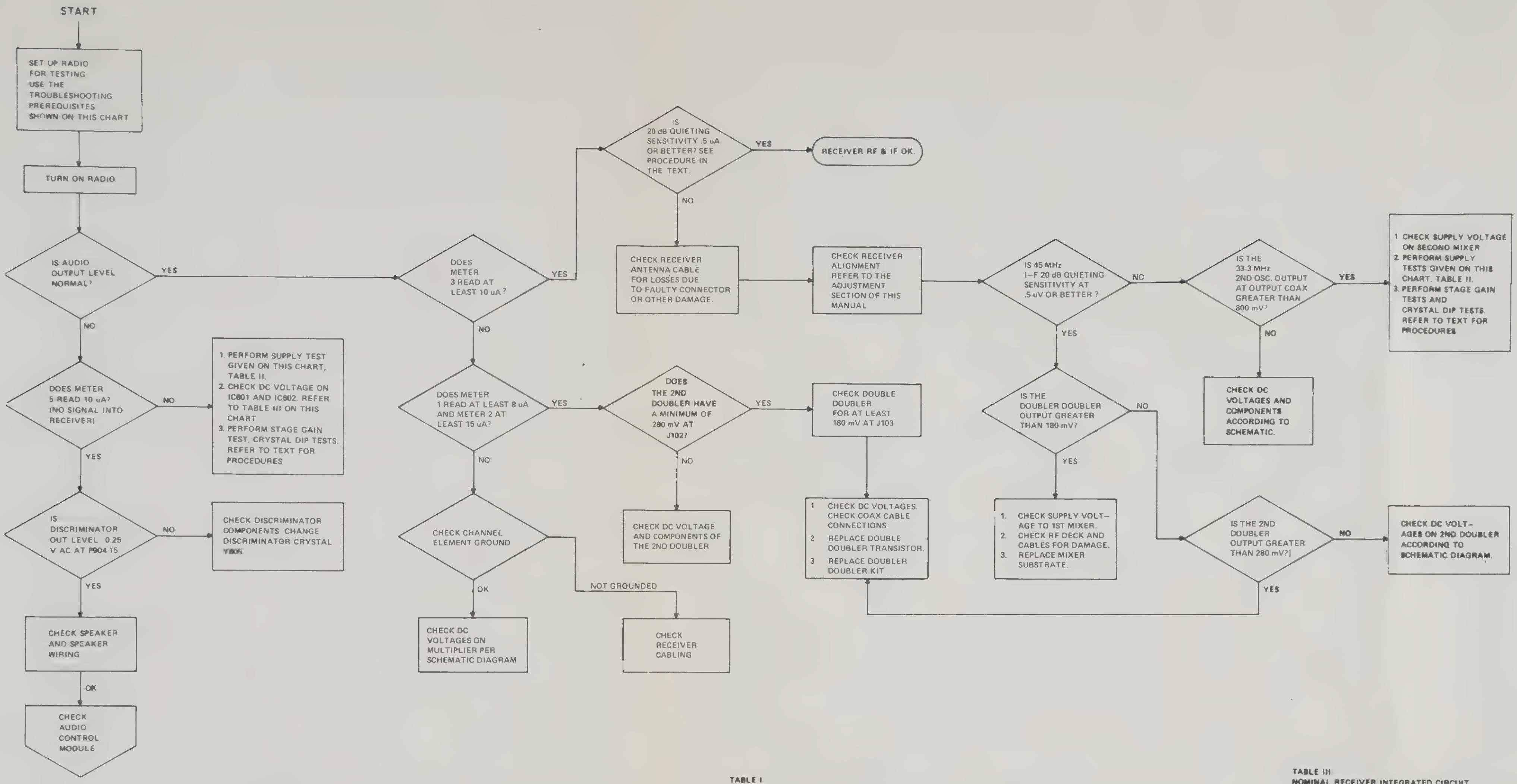


Figure 2. *Typical Dip Plot of a Known Good Crystal in Position Y602 or Y604*


START
SET UP RADIO FOR TESTING USE THE TROUBLESHOOTING PREREQUISITES SHOWN ON THIS CHART
TURN ON RADIO
IS AUDIO OUTPUT LEVEL NORMAL?
YES
NO
DOES METER 5 READ 10 uA? (NO SIGNAL INTO RECEIVER)
NO
1. PERFORM SUPPLY TEST GIVEN ON THIS CHART, TABLE II.
2. CHECK DC VOLTAGE ON IC601 AND IC602. REFER TO TABLE III ON THIS CHART
3. PERFORM STAGE GAIN TEST, CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES
YES
IS DISCRIMINATOR OUT LEVEL 0.25 V AC AT P904 15
NO
CHECK DISCRIMINATOR COMPONENTS CHANGE DISCRIMINATOR CRYSTAL Y805
YES
CHECK SPEAKER AND SPEAKER WIRING
OK
CHECK AUDIO CONTROL MODULE
DOES METER 3 READ AT LEAST 10 uA?
YES
IS 20 dB QUIETING SENSITIVITY .5 uA OR BETTER? SEE PROCEDURE IN THE TEXT.
YES
RECEIVER RF & IF OK.
NO
CHECK RECEIVER ANTENNA CABLE FOR LOSSES DUE TO FAULTY CONNECTOR OR OTHER DAMAGE.
CHECK RECEIVER ALIGNMENT REFER TO THE ADJUSTMENT SECTION OF THIS MANUAL
IS 45 MHz I–F 20 dB QUIETING SENSITIVITY AT .5 uV OR BETTER?
NO
IS THE 33.3 MHz 2ND OSC. OUTPUT AT OUTPUT COAX GREATER THAN 800 mV?
YES
1 CHECK SUPPLY VOLTAGE ON SECOND MIXER
2. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
3. PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES
NO
CHECK DC VOLTAGES AND COMPONENTS ACCORDING TO SCHEMATIC.
YES
IS THE DOUBLER DOUBLER OUTPUT GREATER THAN 180 mV?
YES
1. CHECK SUPPLY VOLT–AGE TO 1ST MIXER.
2. CHECK RF DECK AND CABLES FOR DAMAGE.
3. REPLACE MIXER SUBSTRATE.
NO
IS THE 2ND DOUBLER OUTPUT GREATER THAN 280 mV?]
NO
CHECK DC VOLT–AGES ON 2ND DOUBLER ACCORDING TO SCHEMATIC DIAGRAM.
YES
NO
DOES METER 1 READ AT LEAST 8 uA AND METER 2 AT LEAST 15 uA?
YES
DOES THE 2ND DOUBLER HAVE A MINIMUM OF 280 mV AT J102?
YES
CHECK DOUBLE DOUBLER FOR AT LEAST 180 mV AT J103
1 CHECK DC VOLTAGES. CHECK COAX CABLE CONNECTIONS
2 REPLACE DOUBLE DOUBLER TRANSISTOR.
3 REPLACE DOUBLER DOUBLER KIT
NO
CHECK DC VOLTAGE AND COMPONENTS OF THE 2ND DOUBLER
NO
CHECK CHANNEL ELEMENT GROUND
OK
CHECK DC VOLTAGES ON MULTIPLIER PER SCHEMATIC DIAGRAM
NOT GROUNDED
CHECK RECEIVER CABLING

TROUBLESHOOTING PREREQUISITES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS
   - A. CONNECT THE ADAPTER CABLE 20–PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   - B. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
3. SET PORTABLE TEST SET SWITCHES AS FOLLOWS:
   - A. FUNCTION SWITCH TO THE RCVR POSITION.
   - B. METER REVERSING SWITCH TO OFF POSITION.
   - C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   - D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   - E. D. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
4. ON "PRIVATE–LINE" RADIOS, DISABLE THE PL MODULE.
5. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
6. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.
7. HIGH RF FREQUENCY MEASUREMENTS SHOULD BE MADE WITH AN ACCURATE METER SUCH AS THE MOTOROLA S1339A (SEE EQUIPMENT LIST).

TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO–AMPS)	CIRCUIT METERED
1	8	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	10	SECOND DOUBLER OUTPUT
4	0 ± 2	DISCRIMINATOR OUTPUT
5	10	SECOND I–F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

TEST POINT	DESCRIPTION
P904–9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904–11	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)
P904–8,6	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

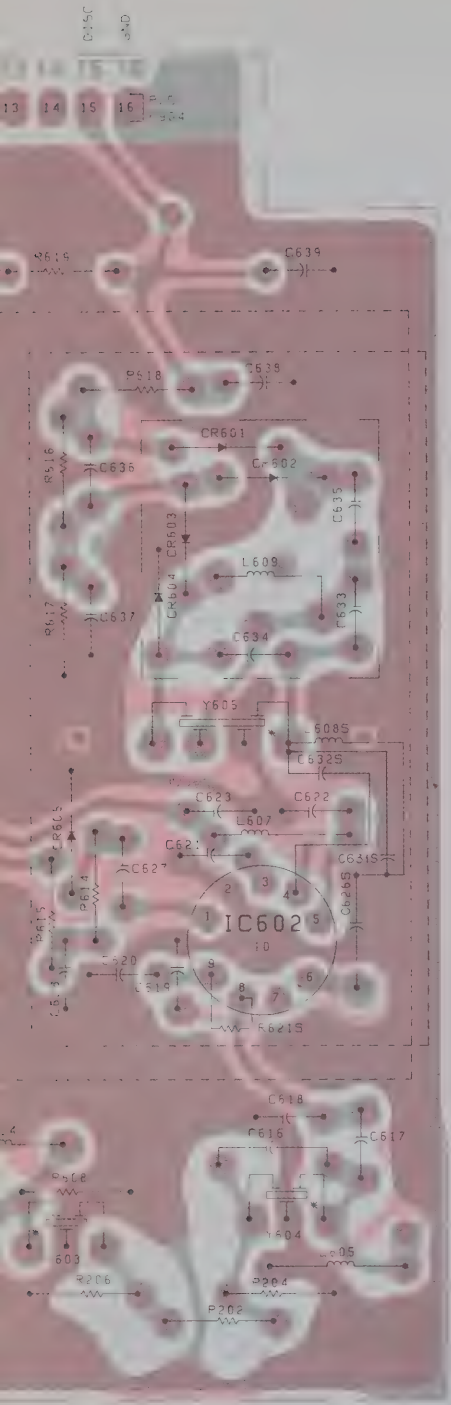
TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

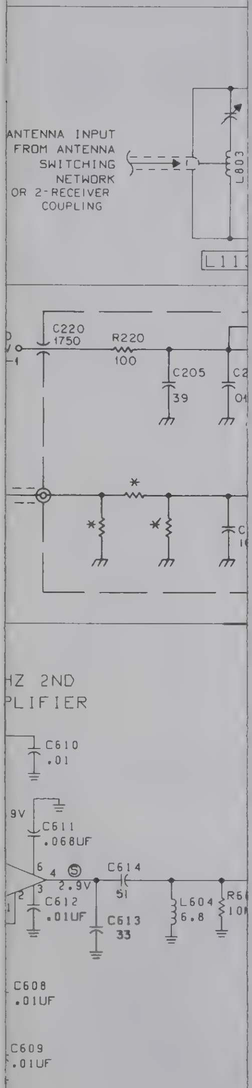
NOTE: ALL VOLTAGES MAY VARY +10% FROM NOMINAL READINGS SHOWN.

DEPS– 35320–0

TRF1032A RF and I-F Board
Troubleshooting Chart
Motorola No. DEPS-35320-O
12/1/82- UP

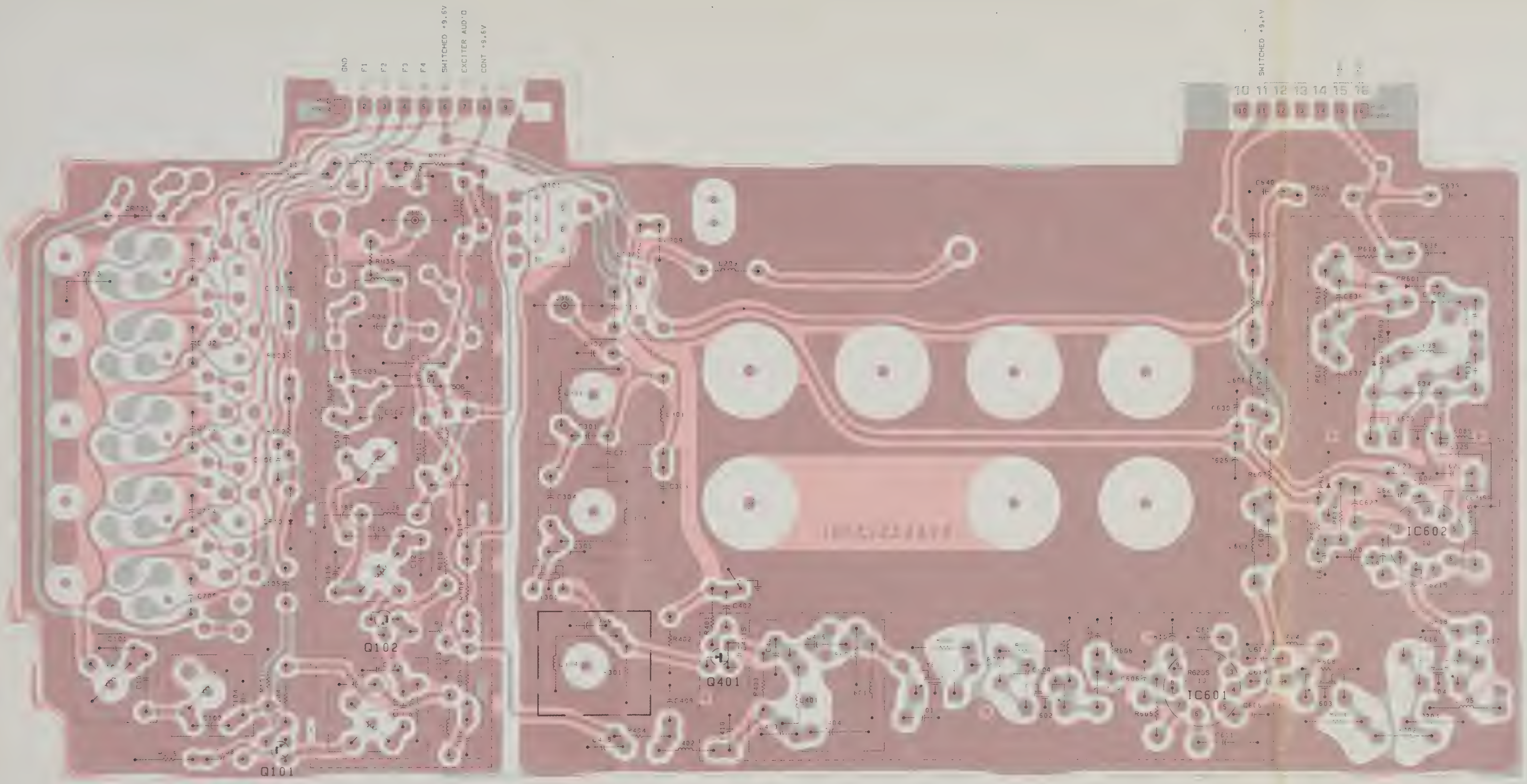

13
14
15
16
R619
C639
R618
C638
CR601
CR602
R616
C636
C635
CR603
L609
CR604
R617
C637
C633
C634
Y605
L608S
C632S
C623
C622
L607
CR615
C621
C631S
C627
R614
R615
C626S
IC602
1
2
3
4
5
6
7
8
9
10
C620
C619
R621S
C618
C616
C617
R608
603
Y604
L605
R206
R204
R202

COMPONENT SIDE BD-EEPS-24370-0
SOLDER SIDE BD-EEPS-24371-0
OL-EEPS-24372-A


ANTENNA INPUT
FROM ANTENNA
SWITCHING
NETWORK
OR 2-RECEIVER
COUPLING
L803
L11
C220
1750
R220
100
C205
39
*
*
*
HZ 2ND
PLIFIER
C610
.01
9V
C611
.068UF
6
4
2.9V
3
2
C612
.01UF
C614
51
C613
33
L604
6.8
C608
.01UF
C609
.01UF

PARTS LISTS SHOWN ON
BACK OF THIS DIAGRAM

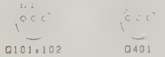
TRF1032A RF and I-F Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-35631-O
(Sheet 2 of 2)
12/1/82- UP


GND
F1
F2
F3
F4
SWITCHED +9.6V
EXCITER AUD'O
CONT +9.6V
1
2
3
4
5
6
7
8
9
SWITCHED +9.6V
10
11
12
13
14
15
16
Q101
Q102
Q401
IC601
IC602

TRF1032A RF and I-F Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-35631-O
(Sheet 1 of 2)
12/1/82- UP

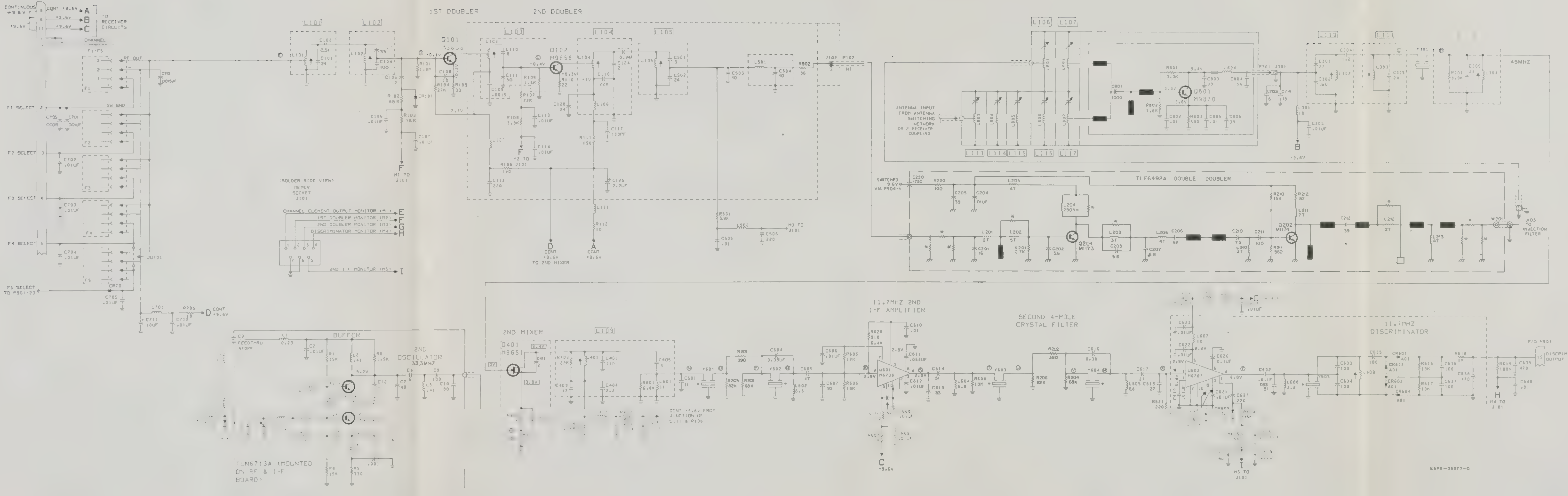
SHOWN FROM SOLDER SIDE

TRANSISTOR LEAD DETAILS
(BOTTOM VIEW)


Q101,102
Q401

— — SHIELD ON COMPONENT SIDE
– – – – – SHIELD ON SOLDER SIDE
PARTS ENDING IN 'S' ARE ON SOLDER SIDE
*–INDICATES CRYSTAL POLARITY

COMPONENT SIDE [illegible]
SOLDER SIDE [illegible]
[illegible] A


1ST DOUBLER
2ND DOUBLER
CHANNEL ELEMENT OUTPUT MONITOR (M1)
1ST DOUBLER MONITOR (M1)
2ND DOUBLER MONITOR (M1)
DISCRIMINATOR MONITOR (M1)
2ND I-F MONITOR (M1)
(SOLDER SIDE VIEW) METER SOCKET J101
F1 SELECT
F2 SELECT
F3 SELECT
F4 SELECT
F5 SELECT
ANTENNA INPUT FROM ANTENNA SWITCHING NETWORK OR 2 RECEIVER COUPLING
TLF6492A DOUBLE DOUBLER
45MHZ
J103 TO INJECTION FILTER
BUFFER
2ND OSCILLATOR 33.3MHZ
2ND MIXER
11.7MHZ 2ND I-F AMPLIFIER
SECOND 4-POLE CRYSTAL FILTER
11.7MHZ DISCRIMINATOR
DISCRIMINATOR OUTPUT
TLN6713A (MOUNTED ON RF & I-F BOARD)
EEPS-35577-0

RECEIVER RF & I F NOTES

101 FREQUENCY CALCULATION

$f_C = 48f_O + 45\ \text{MHZ}$

$f_O = \dfrac{f_C - 45\ \text{MHZ}}{48}$

WHERE f_C = CARRIER FREQUENCY
f_O = CHANNEL ELEMENT FREQUENCY
45 MHZ = 1ST MIXER OUTPUT FREQUENCY (HI I-F)
48 = CHANNEL ELEMENT HARMONIC
11.7 MHZ = 2ND MIXER OUTPUT FREQUENCY (LO I-F)

102 DASHED LINES REPRESENT SHIELDING

103 INDEX DOT ON CRYSTAL CAN INDICATES PHYSICAL ORIENTATION REQUIRED

104 UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS RESISTOR VALUES ARE IN OHMS

105 FOR ACCURATE MEASUREMENT RF VOLTAGES TAKEN WITH MOTOROLA RF MILLIVOLTMETER AND RF PROBE QUADRUPLER OUTPUT WITH 50 OHM BNC TIP PROBE

106 UNLESS OTHERWISE STATED VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND

107 DC VOLTAGE IS FUNCTION OF SIGNAL LEVEL

108 THE TWO-RECEIVER COUPLER MOUNTS IN THE RECEIVER SECTION OF THE UNIFIED CHASSIS THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH RECEIVERS

109 THE 2 RECEIVER COUPLER IS USED IN BASE STATION APPLICATIONS ONLY

TABLE I
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES ALL READINGS ARE IN VOLTS DC MEASURED WITH RESPECT TO CHASSIS

PIN NO	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
[illegible]	[illegible]	[illegible]
10	GND	GND

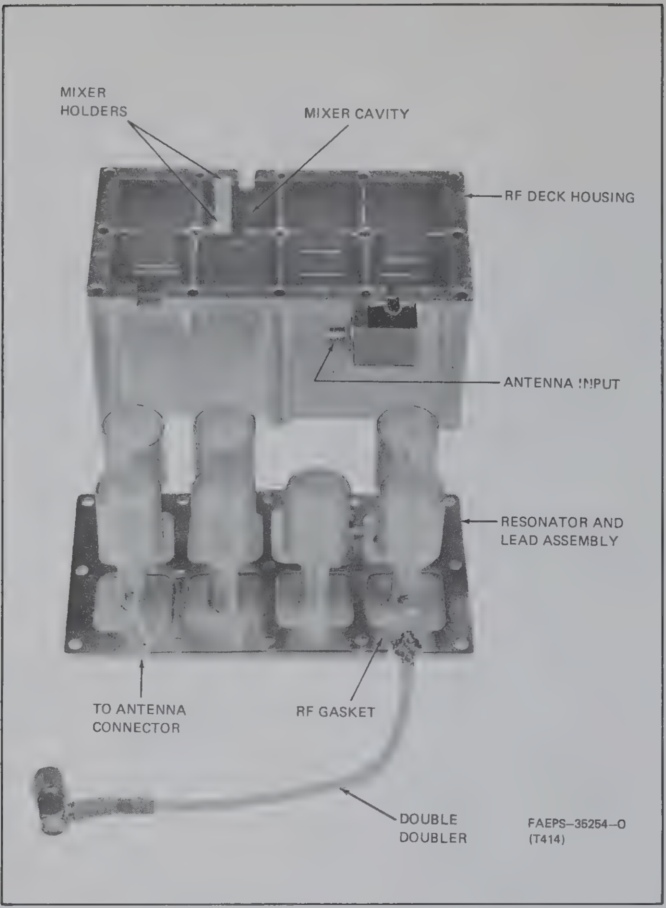
NOTE ALL VOLTAGES MAY VARY FROM NOMINAL READINGS SHOWN

LEGEND

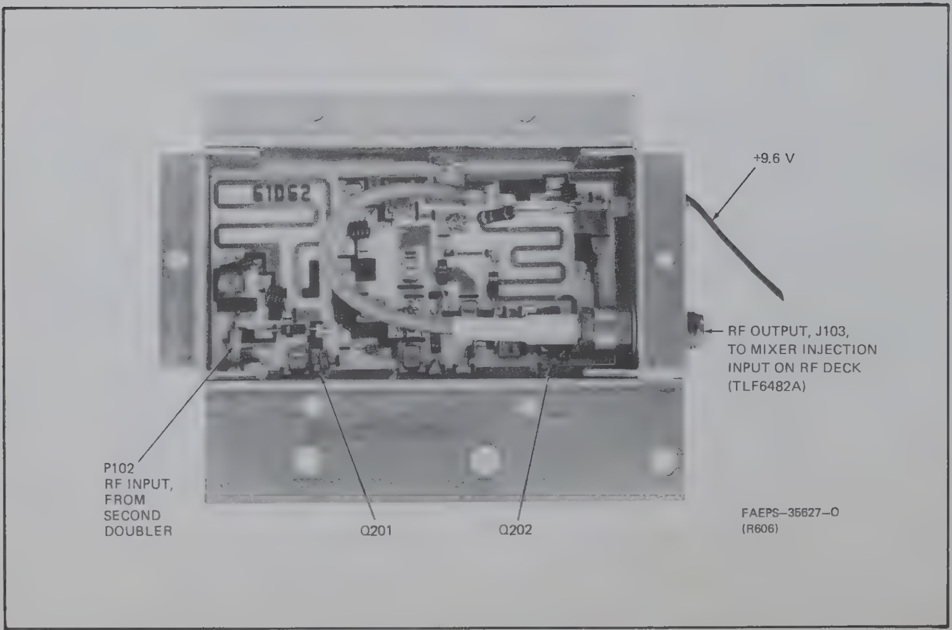
⏚	CHASSIS GND	*	SCREENED RESISTOR
⏚	SUBSTRATE GND	- - -	SHIELDED CABLE OR ENCLOSURE
☐	AREA CAPACITOR	▬	TRANSMISSION LINE

PARTS LISTS SHOWN ON BACK OF THIS DIAGRAM

TRF1032A RF and I-F Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-35631-O
(Sheet 2 of 2)
12/1/82- UP


MIXER HOLDERS
MIXER CAVITY
RF DECK HOUSING
ANTENNA INPUT
RESONATOR AND LEAD ASSEMBLY
TO ANTENNA CONNECTOR
RF GASKET
DOUBLE DOUBLER
FAEPS–35254–O
(T414)

RF DECK


+9.6 V
RF OUTPUT, J103, TO MIXER INJECTION INPUT ON RF DECK (TLF6482A)
P102 RF INPUT, FROM SECOND DOUBLER
Q201
Q202
FAEPS–35627–O
(R606)

DOUBLE DOUBLER

R

TECHNICAL CHARACTERISTICS

y Range		928-960 MHz
cing		25 kHz
tion Acceptance		±8 kHz minimum
		Channel element maintains receiver frequency within ±0.0002% of reference frequency from −30 °C to +60 °C ambient temperature (+25 °C reference).
ance		50 ohms
	20 dB Quieting	0.5 uV
	EIA Sinad	0.35 uV
IA Sinad)		−80 dB @ ±25 kHz
termodulation		−75 dB
Image Rejection		100 dB minimum
itivity uelch (adjustable)		0.25 uV or less at threshold
Squelch		0.25 uV or less
d Squelch		0.25 uV or less

TRF1032A RF and I-F Board
Alignment Procedure
Motorola No. ***PEPS-35633-O***
12/1/82-UP

parts list

TRF6112C Receiver RF and I-F Board PL-8215-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 5%; 500 V: unless otherwise stated
C101	21-82133G74	24; N150
C102	21-82450B29	0.51
C103	21-84493B44	33
C104	21-82610C44	100
C105	21-857336	2 ± .2
C106, 107	21-82428B59	.01 uF + 80-20%; 200 V
C108	21-82355B26	10 ± .25
C109	21-82187B11	.0015 uF ± 10%; 100 V
C110	21-838912	8 ± .25
C111	21-82610C14	30
C112	21-82187B08	220 ± 10%
C113, 114	21-82428B59	.01 uF + 80%20%; 200 V
C115	21-82450B35	0.2 ± 10%
C116	21-82187B08	220 ± 10%
C117	21-831125	100 ± 10%, 300 V
C124	21-857336	2
C125	23-84762H04	2.2 uF ± 20%
C128	21-840365	24
C209	21-82187B20	1000 ± 10%; 100 V
C301	21-83406D37	27
C302	21-84534B05	180
C303	21-82428B59	.01 uF + 80-20%; 200 V
C304	21-82450B08	1.2
C305	21-82133G46	24
C306	21-82133G62	22
C401	21-82610C69	110, 200 V
C402	21-82187B31	1500 ± 10%, 200 V
C403	21-82610C03	47; 200 V
C404	23-84762H04	2.2 uF ± 20%; 25 V
C405	21-82450B11	3; 500 V
C408, 409	21-82428B59	.01 uF + 80-20%; 200 V
C410	8-82905G04	.068 uF ± 10%; 50 V
C411	21-840848	6 pF ± .5 pF
C501	21-82610C94	3 ± .1
C502	21-840365	24
C503, C504	21-83406D89	10
C505	21-82428B59	.01
C506	21-82187B08	220
C601	21-851845	11; NP0
C604	21-82450B07	0.39
C605	21-83406D44	47 ± 0.5%, N080
C606	21-82426B59	.01 uF + 80-20%, 200 V
C607	21-82610C14	30 pF ± 5 pF, N150
C608	21-82428B59	.01 uF + 80-20%, 200 V
C609, 610	21-82428B59	.01 uF + 80-20%, 200 V
C611	8-83813H05	.068 uF ± 10%, 100 V
C612	21-82428B59	.01 uF ± 10%, 200 V
C613	21-82355B09	33 ± 0.5%, NP0
C614	21-82610C29	51 ± 0.5%, N150
C616	21-82450B01	0.30 ± 0.5%
C617, 618	21-83406D37	27 ± 0 5%, N150
C619, 620	21-82428B59	.01 uF + 80-20%; 200 V
C621, 622, 623, 624	23-84762H04	2.2 uF ± 20%; 25 V
C625	21-82428B59	.01 uF + 80-20%; 200 V
C626	8-83813H06	.10 uF ± 10%; 100 V
C627	21-82187B08	220
C628	21-82428B57	.0033 uF ± 10%; 200 V
C629	21-82428B59	.01 uF + 80-20%; 200 V
C630	21-84493B24	40
C631	21-82610C07	51; 200 V
C632	21-861443	.01 uF + 100-20%; 75 V
C633, 634, 635, 636, 637	21-83798B01	100; 200 V
C638, 639	21-82187B39	470 ± 10%
C640	21-82428B59	.01 uF + 80-20%; 200 V
C701 thru 705	21-82428B59	.01 uF + 80-20%, 200 V
C711	23-84762H03	10 uF ± 10%, 20 V
C712	21-82428B59	.01 uF + 80-20%; 200 V
C713	21-82187B11	.0015 uF ± 10%; 100 V
C714	21-00865054	13; N330
C715	21-840848	6 pF ± 0.5 pF
		diode: (see note)
CR101	48-82139G01	germanium
CR601 thru 604	48-84616A01	hot carrier
CR605	48-82139G01	germanium
CR701	48-82392B03	silicon
		connector, receptacle:
J101	9-84207B01	female, 7 contact
J102, J301	9-84231B02	female, single contact
		coil, rf:
L101	24-84972A15	8-1/2 turns; BRN
L102	24-84972A16	6-1/2 turns, RED
L103	24-84972A17	8-1/2 turns; ORG
L104	24-83857G07	12 turns; multiplier
L105	24-83857G05	14-1/4 turns; multiplier
L106, 107	24-83961B01	3 turns, BRN
L111	24-83961B01	3 turns, BRN
L207	24-82723H07	choke, 10 uH
L209	24-82723H05	choke, 0.41 uH; YEL
L301	24-82723H07	choke; 10 uH
L302 thru 304	24-84113B01	7-1/2 turns, BRN
L401	24-84258B05	GRN
L402	24-82723H07	choke; 10 uH
L501	24-83884G01	choke, molded
L502	24-83961B01	3 turns; BRN
L601	24-82549D25	choke; 10 uH
L602	24-84250D02	choke; 6.8 uH
L603	24-82723H07	choke; 10 uH
L604, 605	24-84250D02	choke; 6.8 uH
L606, 607	24-82723H07	choke, 10 uH
L608	24-84250D03	choke, 2.2 uH
L609	24-83879G04	20 turns; YEL
L701	24-83961B01	3 turns; BRN
		transistor: (see note)
Q101, 102	48-869658	NPN, M9658
Q401	48-869651	field-effect
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R101	6-124C55	1.8k
R102	6-124A69	6.8k ± 5%
R103	6-124A55	1.8k ± 5%
R104	6-124C83	27k
R105	6-124A13	33 ± 5%
R106	6-124C29	150
R107	6-124C81	22k
R108	6-124C61	3.3k
R109	6-124C55	1.8k
R110	6-124A09	22 ± 5%
R111	6-124C29	150
R112	6-124C01	10
R113	6-185B64	56, 1/8 W
R201, 202	6-124A39	390
R203, 204	6-124A93	68k
R205, 206	6-124A95	82k
R301	6-124A63	3.9k
R401	6-124C49	1k
R402	6-124A32	220 ± 5%
R403	6-124A81	22k ± 5%
R404	6-124C31	180
R501	6-124A63	3.9k ± 5%
R502	6-185B64	56; 1/8 W
R601	6-124A69	6.8k ± 5%
R605	6-124A75	12k ± 5%
R606	6-124A73	10k ± 5%
R607	6-124C05	15
R608	6-124A73	10k ± 5%
R613	6-124C01	10
R614	6-124A86	36k ± 5%
R615	6-124C53	1.5k
R616, 617	6-124A76	13k
R618	6-124C49	1k
R619	6-124A97	100k
R620	6-124A48	910 ± 5%
R621	6-124A33	220 ± 5%
R706	6-124C01	10
		integrated cicuit: (see note)
U601	51-84267A38	type M6738
U602	51-84267A07	type M6707
		crystal: (see note)
Y301	48-84577K01	45.0 MHz
Y601	48-84755E08	11 7 MHz
Y602 thru 604	48-84755E07	11 7 MHz
Y605	48-84754E01	11 7 MHz (discriminator)
		non-referenced items
	3-134212	SCREW, 4-40 x 5/16"; 10 req'd.
	3-138162	SCREW, tapping; 4-40 x 3/8"; 8 req'd.
	3-138891	SCREW, tapping; 6-32 x 7/16"; 6 req'd.
	4-49854	WASHER, spacer; 2 req'd.
	29-855943	PIN terminal, plated; 20 req'd.
	29-10134A29	LUG, terminal
	29-84028H01	TERMINAL, male; 16 req'd.
	43-868700	BUSHING, threaded; 8 req'd.
	55-84300B02	HANDLE; 2.12"
	55-84300B03	HANDLE, 1.83"

note For optimum performance diodes transistors and integrated circuits must be ordered by Motorola part numbers.

TLN5891A Receiver Shield Kit PL-8217-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-139495	SCREW, tapping; 6-32 x 5/16"; 5 used
	26-82640L01	SHIELD

TRF6482A RF Deck PL-8216-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 20%; 500 V: unless otherwise stated
C801	21-84547A01	1000-20%; 50 V
C802	21-84547A05	10000 pF
C803	21-84736E12	39 pF ± 5%; 500 V
C804	21-84873H17	56 pF ± 10%; 50 V
C805	21-84547A05	10000 pF
C806	21-84736E12	39 pF ± 5%; 500 V
		connector, receptacle:
J102	8-82547L02	female; single contact
		coil, rf:
L801 thru 807	1D83010K03	resonator and lead assy.
L808	76-83960B01	ferrite bead
L809	24-82723H05	choke; 0.41 uH
		connector, plug:
P301	28-84282D01	male; single-contact
P102	28-87317C01	male; single contact
		transistor: (see note)
Q801	48-869870	NPN; M9870
R801, 802, 803		cannot be replaced
		mechanical parts
	3-134268	SCREW, tapping: 4-40 x 7/16"; 4 req'd.
	15-84630E01	COVER, connector (J801)
	42-83032K01	HOLDER; 2 req'd.
	64-83018K02	PLATE, cover
	29-5227	LUG, soldering; #6; 2 req'd
	15-83014K01	HOUSING, rf deck
	2-84773E03	NUT, tension; 7 req'd.
	3-84997K01	SLUG TUNING; 7 req'd.
	32-82101L02	GASKET
	3-136138	SCREW, tapping: 6-32 x 3/8"; 11 req'd.
	32-82555M01	GASEKET, lead

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN6713A 2nd Oscillator Kit PL-4217-O

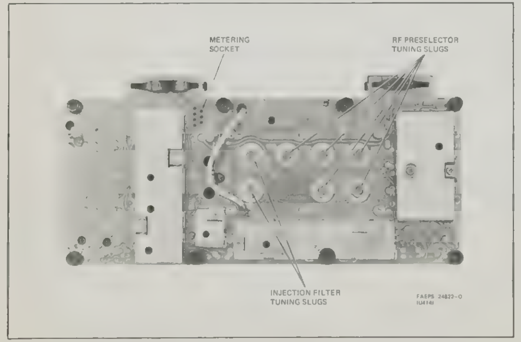
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: ± 5%: unless otherwise stated
C1	20-82399D04	variable; 5.5-18 pF
C2	21-82428B59	.01 uF + 80-20%, 200 V
C3	21-821474	470 pF ± 20%; 500 V
C4	21-82355B09	33 pF; 500 V
C5	21-831125	100 pF ± 10%; 300 V
C6	21-82187B14	.001 uF ± 10%; 100 V
C7	21-84395B01	40 pF; 500 V
C8	21-840848	6 pF ± 0.5 pF, 500 V
C9	21-82610C44	100 pF ± 10%; 100 V
C10	21-82880E33	80 pF; 800 V
C11	21-82187B14	.001 uF ± 10%; 100 V
C12	21-840848	6 pF ± 0.5 pF; 500 V
C13	21-82204B22	5 pF; 250 V
		coil, rf:
L1	24-82723H04	choke, 0.29 uH
L2	24-82723H05	choke; 0.41 uH
L3	24-890687	choke, 2 0 uH
L4	24-82723H01	choke; 1.2 uH
L5	24-82723H05	choke; 0.41 uH
		transistor: (see note)
Q1, 2	48-869494	NPN, type M9494
		resistor, fixed: ± 10%; 1/4 W: unless otherwise stated
R1, 2	6-124C77	15k
R3	6-124C51	1.2k
R4	6-124C77	15k
R5	6-124A37	330 ± 5%
R6	6-124A53	1.5k ± 5%
		crystal:
Y1	48-83860F09	33.3 MHz
		mechanical parts
	3-139012	SCREW, 4-40 x 1/4"
	4-474216	WASHER, 2 req'd.
	15-82304L01	COVER
	43-83066F05	BUSHING; 0.250" length; 2 req'd.
	43-83066F06	BUSHING, 0.170" length
	43-83617D01	BUSHING, round
	14-84602K02	INSULATOR, crystal; 2 req'd.
	26-82303L01	SHIELD
	43-82555L01	SPACER, threaded (oscillator shield)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

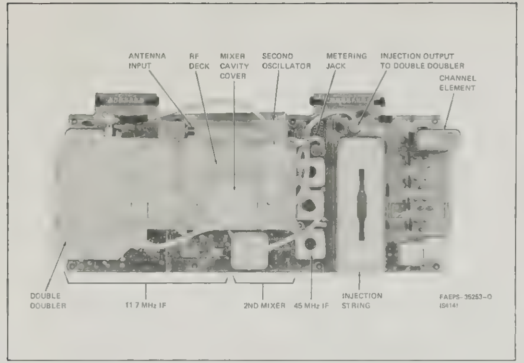
TLF6492A Double Doubler Board (Rcvr.) PL-8244-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF; 50 V: unless otherwise stated
C201	21-84736E08	16 ± 5%
C202	21-84736E18	5.6 ± 0.5 pF
C203	21-84736E18	5.6 ± 0.25 pF
C204	21-84547A05	.01 uF ± 20%
C205	21-84736E12	39 ± 5%
C206	21-84736E31	56 ± 10%
C207	21-84736E17	6.8 ± 0.5 pF
C210	21-84736E29	7.5 ± 0.25 pF
C211	21-84736E21	100 ± 5%
C212	21-84736E12	39 ± 5%
C220	91-87511C01	RFI, 1750
		connector, receptacle:
J103	9-87318C04	female, panel mounting
		coil, rf:
L201	24-84311M22	2-turns
L202	24-84311M39	5-turns
L203	24-84331M44	3-turns
L204	24-82723H40	290 nH
L205, 206	24-84331M10	4-turns
L210	24-84331M44	3-turns
L211	24-84331M47	7-turns
L212	24-84331M22	2-turns
L213	24-84331M45	4-turns
		connector, plug:
P102	28-84282D01	phono, male
		transistor: (see note)
Q201	48-84411L73	NPN; M1173
Q202	48-84411L74	NPN; type M1174
		resistor, fixed: ± 5%; 1/8 W:
R201	6-185B84	2.7 kohms ± 10%
R210	6-185A77	15k
R211	6-185A49	560
R212	6-185A23	82
R220	6-185A25	100
		cable assembly:
W1	1-80791B63	consists of: ref. item P102
	30-83794C01	CABLE, coaxial; 11" used
	29-5227	LUG, solder; 2 used
W201	1-80764D86	consists of: ref. item J103
	30-859004	CABLE, coaxial; 3.5" used
		mechanical parts
	29-83208M01	LUG, solder
	3-134169	SCREW, tapping; 4-40 x 1/4"; 6 used
	15-82575L01	HOUSING, quadrupler
	30-10151A17	WIRE, flat
	64-82576L01	PLATE, cover
	39-10184A24	CONTACT, receptacle

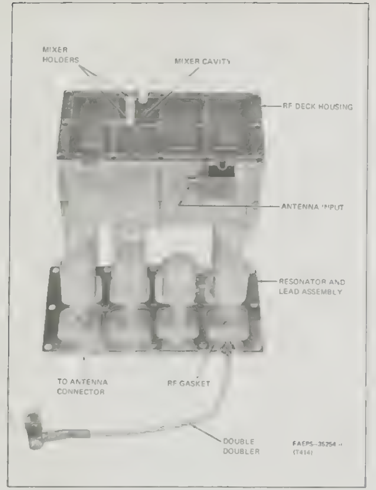
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers



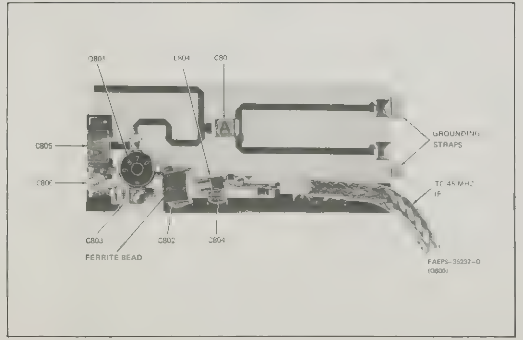
RECEIVER REAR VIEW



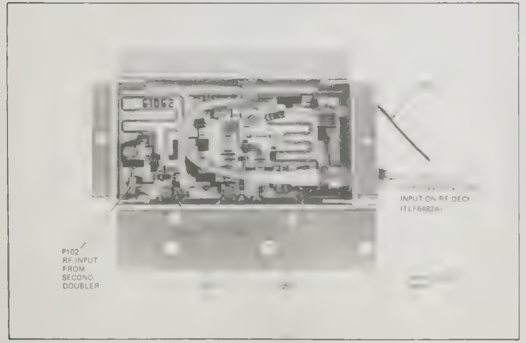
RECEIVER FRONT VIEW



RF DECK



MIXER BOARD



DOUBLE DOUBLER

RECEIVER ALIGNMENT PROCEDURE

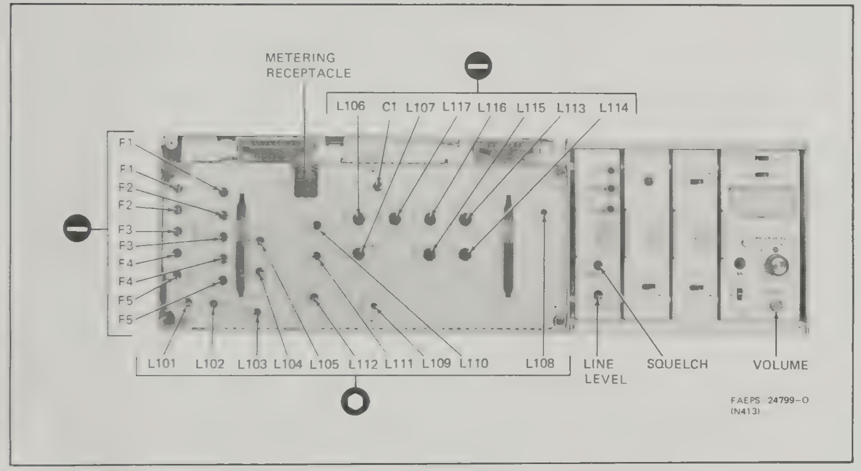
A. FREQUENCY CALCULATIONS

Where:

f_o = channel element frequency
f_c = carrier frequency

$$f_o = \frac{f_c - 45\ \text{MHz}}{48}$$

B. RECEIVER ADJUSTMENT LOCATIONS



C. MINIMUM RECEIVER METER READINGS
(NO INPUT SIGNAL APPLIED)

Test Set Selector Switch Position	Reading (uA)	Circuit Metered
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4 + , 4 −	0 ± 2	Discriminator Output
5	10	Second I-F Amplifier and Limiter

D. RECEIVER ALIGNMENT

Step	Adjust	Meter Position	Stage and Procedure
1	L101, L102, L103, L104, L105		MULTIPLIER COILS — Adjust the cores of L101, L102, L103, and L105 to the end of the coil form flush with the printed circuit board. Adjust the core of L104 to the end of the coil form away from the printed circuit board.
2	L110, L111, L112		FIRST I-F COILS — Adjust the cores of L110, L111, and L112 to the end of the coil form flush with the printed circuit board.
3	L106, L107, L113, L114, L115, L116, L117		PRESELECTOR AND INJECTION FILTER — Adjust the slugs at L106, L107, and L113 through L117 away from the rf deck until they stop. Adjust L106 four turns clockwise and L117 two turns clockwise.
4	L101, L102	1	CHANNEL ELEMENT OUTPUT — Adjust L102 two turns clockwise. Alternately turn L101 and L102 clockwise 1/2 turn at a time until a peak indication is achieved on meter 1.
5	L103, L104	2	FIRST DOUBLER — Tune L103 for a peak reading on meter 2. Tune L104 counterclockwise until meter 2 dips.
6	L104, L105	3	DOUBLE DOUBLER — Tune L105 clockwise until a peak reading is achieved on meter 3. Tune L104 until a peak reading is achieved on meter 3. Repeak L104 and L105 until no further improvement is obtained.
7	L108	4, 5	DISCRIMINATOR — Insert the center conductor of the output cable from a 11.7 MHz test oscillator into the L109 hole on the receiver shield. Do not contact the circuit board. Insert the conductor far enough to obtain a saturated reading on meter 5. By tuning L108, it should then be possible to obtain readings on either side of zero (center) on meter 4. Tune L108 for an EXACT zero (center) reading. *This adjustment is critical.*
8	L109	5	SECOND I-F COIL — Insert the 11.7 MHz injection probe into the L112 hole in the receiver shield. Tune L109 for a peak reading on meter 5, keeping meter 5 out of saturation by moving the probe.
9	C1	4, 5	SECOND OSCILLATOR WARP CAPACITOR — Insert the 45 MHz injection probe into the L112 hole in the receiver shield. Tune C1 until quieting is obtained and meter 5 increases. Tune C1 for an EXACT zero reading on meter 4. *This adjustment is critical.*
10	L110, L111, L112	5	FIRST I-F COILS — Insert the 45 MHz injection probe in the L110 hole on the receiver shield. Tune L112 clockwiise for a peak reading on meter 5, keeping the meter out of saturation by moving the probe. Tune L111 clockwise for a peak reading on meter 5, keeping the meter out of saturation. Remove the probe and turn L110 ten turns clockwise.
11	L106	4, 5	INJECTION FILTER — Unsquelch the receiver and connect an rf signal generator to the antenna connector. Set the rf output level of the generator to maximum and set the generator to the carrier frequency. Tune L106 for a peak reading on meter 5, reducing the generator level as necessary to keep meter 5 out of saturation.
12	L107, L105, L104	3, 5	Detune L105 until meter 3 drops to 10 uA. Tune L107 for a peak reading on meter 5. Tune L105 for a peak reading on meter 3. Repeak L104 and L105 until no further improvement is obtained.
13	L113, L114, L115, L116, L117	5	RF PRESELECTOR — Tune L117, L116, L113, L114 and L115 in that order for a peak reading on meter 5. Reduce the generator level as necessary to keep meter 5 out of saturation.
14	L113, L114, L115, L116, L117	5	Tune L113, L114, L115, L116, L117 in that order for best noise quieting.
15	L110, L111, L112, L109	5	FM modulate the carrier frequency with a 1 kHz tone at 7.5 kHz deviation. Peak L110, L111, L112, and L109 in that order for a maximum reading on meter 5.
16	F1	4	Adjust F1 channel element. Inject a known, accurate carrier frequency into the receiver. Adjust the channel element warp capacitor for a zero reading on meter position 4.
17	—	—	Perform 20 dB quieting sensitivity measurements to check alignment.

MODEL TABLE

Model	Model Breakdown	Description
TRF1032A	TRF1181A	RF Injection Deck
	TRF6112A	Receiver RF & I-F Board
	TRN6713A	Second Oscillator
TRF1181A	TLF6482A	RF Deck
	TLF6492A	Double Doubler

TECHNICAL CHARACTERISTICS

RF Frequency Range		928-960 MHz
Channel Spacing		25 kHz
EIA Modulation Acceptance		± 8 kHz minimum
Frequency		Channel element maintains receiver frequency within ± 0.0002% of reference frequency from − 30 °C to + 60 °C ambient temperature (+ 25 °C reference).
Input Impedance		50 ohms
Sensitivity	20 dB Quieting	0.5 uV
	EIA Sinad	0.35 uV
Selectivity (EIA Sinad)		− 80 dB @ ± 25 kHz
EIA Sinad Intermodulation		− 75 dB
Spurious and Image Rejection		100 dB minimum
Squelch Sensitivity Carrier Squelch (adjustable)		0.25 uV or less at threshold
Tone-Coded Squelch		0.25 uV or less
Digital-Coded Squelch		0.25 uV or less

TRF1032A RF and I-F Board
Alignment Procedure
Motorola No. ***PEPS-35633-O***
12/1/82-UP

"MICOR" "SENSITRON" RECEIVER AUDIO & SQUELCH BOARD

MODEL TRN8406A

1. DESCRIPTION

1.1 The audio and squelch board performs two basic functions -- audio amplification and audio squelching. The first two stages in the audio circuitry amplify the signal from the discriminator and provide the proper frequency response. This signal is routed to the line driver module in remote control stations and to the local logic board in local control models. The audio returns through a VOLUME control. The remaining stages in the audio circuitry take the signal returning from the line driver and VOLUME control and provide the necessary frequency response at the speaker. These latter stages also provide the driver required by the final audio amplifiers (located on a separate board) for rated power output. An integrated circuit and one transistor perform all of the above functions.

1.2 The squelch circuitry disables the audio path during intervals between received messages. One integrated circuit performs the necessary detection and squelching functions. Also, in conjunction with the PL decoder and filter board in a PL station, this integrated circuit provides unsquelching when PL signals are received.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 The audio signal from the receiver discriminator is routed to the emitter follower (refer to Figure 1.). The emitter follower output is coupled to the SQUELCH control mounted on the receiver chassis or local front panel and also to the line level potentiometer mounted on the audio & squelch board. The signal from this control is next applied to the preamplifier. If JU201 is cut, the signal is first sent through the PL filter for attenuation of the PL tone. The preamplifier output is coupled off the board to the line driver or local-logic board. Audio returning from the line driver or local-logic board is coupled through the appropriate VOLUME control to amplifier Q203. After amplification, the signal is applied to the audio amplification circuits. Here, the signal is raised to a level sufficient to drive the audio final amplifier. These are mounted on a separate board which is secured to the chassis to provide "heat-sinking" capability. The output of the audio power amplifiers is applied to an output transformer which drives a speaker or speaker desk-set transformer (local control stations only).

2.1.2 The signal returned from the SQUELCH control is applied to the squelch section for noise squelch control. Squelch action is achieved by utilizing the inherent characteristic of a discriminator known as noise quieting. An input signal will cause more quieting of noise as the signal level is increased. When a desired level of noise quieting is reached, as determined by the squelch circuitry and the setting of the SQUELCH control, the audio portion of the board and line driver are enabled to allow a message to be heard. In a remote control station, the squelch circuit disables the audio circuitry by shunting a point in the audio signal path to ground and also operating a series switch in the audio signal path of the line driver.

2.1.3 In a local control station, the series path is broken on the local-logic board. In addition, an extra shunt switch is activated on this board and its low resistance is directed back to the audio amplification circuits. This provides extremely quiet operation during periods of no signal.

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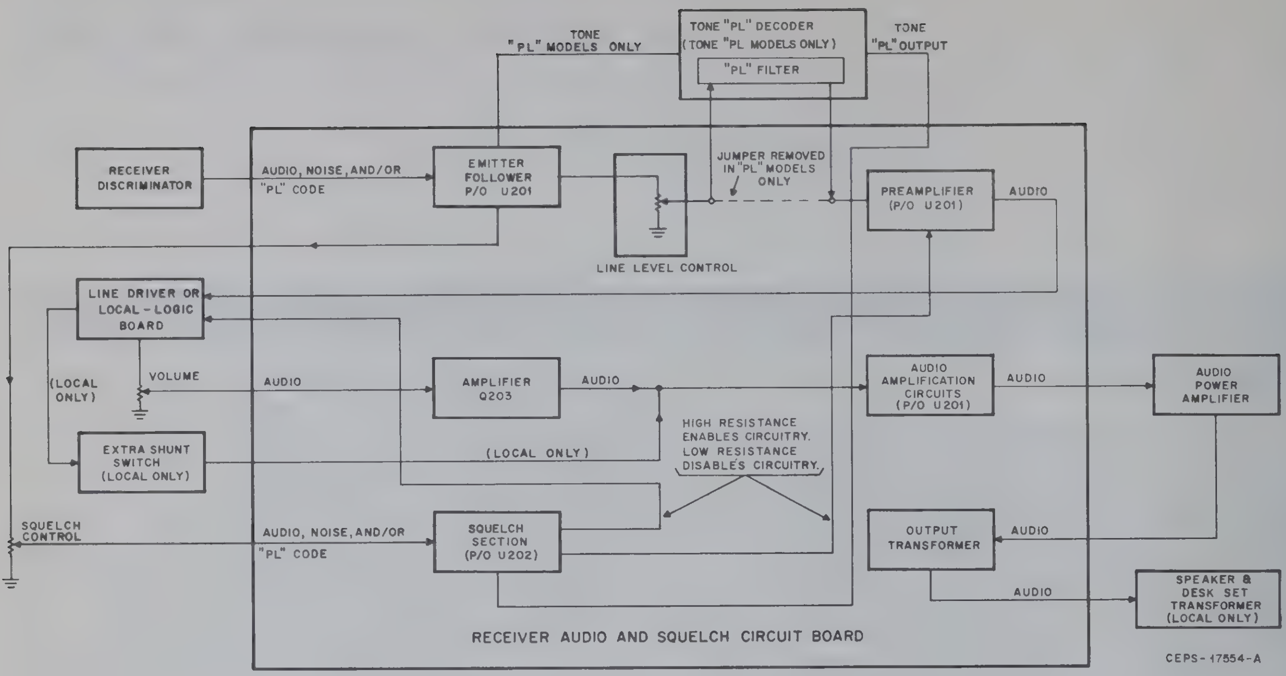

TONE "PL" MODELS ONLY
TONE "PL" DECODER (TONE "PL MODELS ONLY)
"PL" FILTER
TONE "PL" OUTPUT
RECEIVER DISCRIMINATOR
AUDIO, NOISE, AND/OR "PL" CODE
EMITTER FOLLOWER P/O U201
JUMPER REMOVED IN "PL" MODELS ONLY
PREAMPLIFIER (P/O U201)
AUDIO
LINE LEVEL CONTROL
LINE DRIVER OR LOCAL - LOGIC BOARD
(LOCAL ONLY)
VOLUME
AUDIO
AMPLIFIER Q203
AUDIO
AUDIO AMPLIFICATION CIRCUITS (P/O U201)
AUDIO
AUDIO POWER AMPLIFIER
HIGH RESISTANCE ENABLES CIRCUITRY. LOW RESISTANCE DISABLES CIRCUITRY.
EXTRA SHUNT SWITCH (LOCAL ONLY)
(LOCAL ONLY)
SQUELCH CONTROL
AUDIO, NOISE, AND/OR "PL" CODE
SQUELCH SECTION (P/O U202)
OUTPUT TRANSFORMER
AUDIO
AUDIO
SPEAKER & DESK SET TRANSFORMER (LOCAL ONLY)
RECEIVER AUDIO AND SQUELCH CIRCUIT BOARD
CEPS-17554-A

Figure 1.
Audio and Squelch Block Diagram

2.1.4 Upon completion of a received message, audio shut-off is either immediate or automatically delayed 150 milliseconds, depending upon the signal level of the previously received rf carrier. A strong signal produces the immediate shut-off and prevents an annoying, loud "squelch tail" burst from being heard. Weak signals (signals that produce less than 20 dB noise quieting) produce the long shut-off delay and prevent a message from being chopped under "flutter" conditions. Since the received signal level must be low for the long turn-off delay to occur and the "squelch tail" level is comparable to that of the received signal, the "squelch tail" is not annoying.

2.2 EMITTER FOLLOWER CIRCUIT

2.2.1 The emitter follower circuit provides a low impedance output which isolates the high impedance discriminator output from the following squelch and audio circuitry.

2.2.2 The output of the discriminator is capacitively coupled to the emitter follower input at U201-1 and may consist of noise and audio signals. The output of the emitter follower at U201-2 is routed through C207 to the SQUELCH control.

2.3 PREAMPLIFIER CIRCUIT

This circuit amplifies the low-level audio signal to provide the drive necessary for proper line driver operation. In addition, a negative feedback network (C208 and C209) provides the necessary frequency response characteristics for phone line operation. In PL stations, jumper JU202 is cut and the negative feedback is provided by C209 only. The network of R210 and C210 provides additional frequency response shaping.

2.4 AMPLIFIER CIRCUIT

Transistor Q203 increase the signal level from the line driver or local-logic board to the level required by the audio amplification circuits. Jumper JU203 is out when the equipment leaves the factory. The gain of Q203 is sufficient to drive the audio amplification circuits if the signal strength from the line driver or squelch gate exceeds -10 dBm. With a signal strength below this level, it is advisable to put in JU203 which increases the gain of Q203. The RC network at the input to this stage provides additional frequency response shaping required at the speaker.

2.5 AUDIO AMPLIFICATION CIRCUIT

2.5.1 The signal from amplifier Q203 is applied to the differential amplifier through capacitors C211 and C213. In a local station, the extra shunt switch on the local-logic board is connected to the junction of C211 and C213.

2.5.2 The differential amplifier output provides the drive for the complementary amplifier. Resistors R221 and R220 form a voltage divider biasing the differential amplifier at one-half of the supply voltage. Undesirable transient voltages are eliminated by capacitor C212.

2.5.3 Final audio amplification on the audio and squelch board occurs in the complementary amplifier. These stages provide the drive for the audio power amplifiers which are mounted on a separate board. The complementary amplifier emitter resistors (R218 and R219) are not included in U201 because of their high heat dissipation requirements.

2.5.4 Audio returned to the audio and squelch board (from the audio power amplifier transistors) is applied to the output transformer primary windings. This transformer consists of four windings -- two input primaries, an output secondary, and a feedback secondary. The output secondary winding couples audio power to an external 8-ohm speaker which can be driven with up to 10 watts at less than 5% distortion. Negative feedback from the output transformer winding through C216 and across R211 gives 6 dB per octave de-emphasis (roll-off) to the audio which has been pre-emphasized 6 dB per octave in the transmitter. Below 300 Hz, feedback from R213 and across C215 increases giving low frequency de-emphasis. Capacitor C238 rolls off the high frequency gain of the amplifier to prevent high frequency oscillation. Capacitors C223 and C224, C240, C241, and C242 are rf bypass capacitors that shunt stray rf on the audio A+ and audio A- lines to ground. In local operation the output secondary winding couples audio power to a 16-ohm speaker and an autotransformer. This transformer will drive up to six local desk sets.

2.6 NOISE ACTIVATED SQUELCH CIRCUIT

2.6.1 Squelch Input Circuit

2.6.1.1 The input signal from the SQUELCH control may consist of audio and noise. An input shaping network precedes U202 and passes high frequencies while attenuating low frequencies. Allowing the high frequencies to pass eliminates the effect of voice and results in more sensitive threshold squelch action.

2.6.1.2 The first amplifier and limiter is driven into limit by its input signal and prevents audio from squelching (disabling) the audio channel on voice signals. Amplified, limited noise is then passed through a coupling network to the second amplifier. This coupling network is also a high pass filter which further attenuates voice and tone signals to the second amplifier.

2.6.1.3 The second amplifier amplifies the noise signal and applies it through an RC coupling network to the detector. Capacitor C233 and C234 form another high pass filter that attenuates the low frequencies. Capacitor C234 is used to produce a peak-to-peak detector action from the noise detector, and thus, generate twice the output voltage of a peak detector. This capacitor does not affect frequency response.

2.6.2 Detector and Switching Circuits

2.6.2.1 The detector output level is a function of received signal strength and the setting of the SQUELCH control. The detector develops the dc output voltage across filter capacitor C235. The lowest dc output voltage corresponds to a no signal input (maximum noise) condition. The output voltage increases as the received rf carrier signal level increases (noise decreases).

2.6.2.2 The primary function of the detector output, however, is the control of shunt switching. This is done by applying the detector output to three squelch control circuits simultaneously:

-- long "squelch-tail" circuit

-- long "squelch-tail" defeat switch

-- carrier squelch switching logic

2.6.2.3 With no received rf carrier signal (maximum noise condition), the long "squelch tail" circuit and long "squelch tail" defeat switch are "off" and the carrier squelch switching logic is "on". The audio channel is subsequently disabled unless the squelch control logic is overridden by other circuitry.

2.6.2.4 As the input signal level increases (noise decreases), the detector output voltage increases. A detector output voltage above 2.8 volts dc results in enabling of the long "squelch tail" circuit. The long "squelch tail" circuit produces a voltage at U202-12 of 5.5 volts dc; this voltage causes the carrier squelch switching logic circuit to turn "off" and thereby enables the audio channel. Capacitor C236 and resistor R235 provide a rapid-rise, slow-decay time constant to the voltage applied to the carrier squelch switching logic circuit. This permits a weak signal to immediately enable the audio channel, yet delays the audio channel shut-off if the signal is in a "flutter" condition. The voltage necessary to enable the carrier squelch switching logic is approximately 3.8 volts dc.

2.6.2.5 A voltage greater than 5 volts dc at the detector output (rf carrier signal level that produces 20 dB quieting or better with the SQUELCH control set at threshold), turns on the long "squelch tail" defeat switch. This disables the long "squelch tail" circuit and the 150 millisecond delay function. Audio channel disabling now occurs immediately after the rf carrier disappears.

2.6.3 Squelch Output Circuit

The squelch control logic circuit directly controls the shunt switches.

2.6.3.1 The output of the squelch control logic circuit depends upon the output of the preceding carrier squelch switching logic circuit. With the carrier squelch switching logic circuit "off", the squelch control logic circuit will turn off the shunt switches, allowing a message to be heard. If the carrier squelch switching logic is "on", the squelch control logic circuit will turn on the shunt switches, disabling the audio channel, and activating the series switches in the line driver or local-logic board. Capacitor C237, connected to U202-10, slows the turn-off of the shunt switches to "soften" what would otherwise be an annoyingly abrupt turn-on of the audio. This same point (U202-10) supplies a digital output voltage that can be used as an indicator that the receiver is unsquelched (audio channel enabled).

2.6.3.2 Two additional functions that may affect the squelch control logic output are associated with "Private-Line" operation. PL disable (U202-14) may be either shorted to ground or open. When an open is present at U202-14 (PL disabled), a received signal with or without a PL code will be heard from the speaker. When at ground potential (PL enabled), the output of the carrier squelch switching logic circuit is inhibited. When the proper PL code is received, a positive 9.5 volts dc from the PL decoder board to U202-8 turns off the squelch control logic circuit which turns off the shunt switches and allows a message to be heard. Jumper JU204 is normally in the circuit and is only cut when a field modification is made. The cutting of this jumper and associated modifications on the receiver interconnect board will provide "AND-SQUELCH" operation, changing the PL squelch circuitry from fixed sensitivity operation to variable sensitivity operation. Under this mode of operation, the SQUELCH control will affect the squelch sensitivity.

2.6.3.3 Audio disabling is performed by shunting the audio circuit to ground through a low impedance path and also by the operation of a series switch in the line driver or local-logic board. When the solid state shunt switch is turned "on" (U202-7), signals developed across R236 are shunted to ground. This prevents any signals from being heard at the speaker. Acting in tandem with the first shunt switch, the second shunt switch output is routed to the line driver or local-logic board and enables a set of switches on either of the boards. In a remote control system, this breaks the audio path and prevents audio from appearing on the 600-ohm line. In a local control system, these series switches also break the audio path, thus preventing any audio or hum and noise from reaching the speaker.

3. MAINTENANCE

3.1 GENERAL

This section of the manual provides maintenance shop type procedures for the audio and squelch board. It assumes that preliminary tests have already localized the trouble to this board. These bench tests include procedures for testing and troubleshooting, including integrated circuit check-out.

NOTE

The audio and squelch board must be installed in a station for testing to provide the necessary power and ground connections.

3.2 PERFORMANCE TESTS

The performance tests may be used for troubleshooting to isolate the point of abnormal operation. They may also be used after repair to assure that the board is operating properly before it is returned to service.

3.2.1 Audio Amplification

3.2.1.1 Specifications

The audio section of the audio and squelch board combined with the separate audio power amplifier transistors will provide at least 10-watts (5 watts local) audio output at less than 5 per cent distortion from a 3.0 kHz deviated, 1 kHz modulated on-frequency signal applied to the station antenna receptacle.

3.2.1.2 Procedure

Step 1. Replace the speaker with an 8-ohm, 15-watt non-inductive resistor. In local control stations, disconnect the autotransformer.

Step 2. Set the SQUELCH control fully counterclockwise (unsquelched). "Private-Line" stations must also be PL disabled.

Step 3. Connect an rf signal generator to the station antenna receptacle and adjust it to the receiver frequency.

Step 4. Adjust the signal generator for 1000-microvolt output, modulated with 1000-Hz tone at ±5.0 kHz deviation.

Step 5. Connect an AC voltmeter to pin J903-7 at the receiver interconnect board.

Step 6. Adjust the line level control R203 for 175 mV ac rms.

Step 7. Reduce the deviation to ±3.0 kHz.

Step 8. Connect an AC voltmeter across the 8-ohm resistor.

Step 9. Adjust the VOLUME control until 9.0 volts ac rms is read on the ac voltmeter (this represents 10 watts).

Step 10. Measure distortion at 10-watts audio power output. It should be less than 5 per cent.

3.2.2 Squelch Control

3.2.2.1 Specifications

3.2.2.1.1 The squelch section of the receiver audio and squelch board shall enable the audio section when an rf signal level greater than 6 dB noise quieting (one-half the discriminator output level with no signal input) is applied to the receiver with the SQUELCH control set at threshold. When the signal is removed from the station, the audio channel shall become disabled after approximately 150 milliseconds. When an input signal greater than that required for approximately 20 dB noise quieting is removed from the station, the audio channel shall become disabled immediately.

3.2.2.1.2 When the SQUELCH control is turned fully clockwise (tight squelch) an input signal that produces about 20 dB noise quieting shall be required to enable the audio channel.

3.2.2.1.3 The squelch section shall inhibit audio output when no input signal is received.

3.2.2.1.4 In "Private-Line" stations, the squelch section of the receiver's audio and squelch board shall perform as described in paragraphs 3.2.2.1.1, .2, and .3 while the radio set is PL disabled.

3.2.2.1.5 In PL operation, the squelch section shall inhibit audio output when the proper PL code is not received, regardless of the input signal strength.

3.2.2.2 Procedure

3.2.2.2.1 Carrier Squelch Stations

Step 1. Turn the station on and adjust the SQUELCH control clockwise from the full counterclockwise position until the receiver just quiets (threshold squelch).

Step 2. Measure the resistance of U202-6 and -7 with reference to ground. Both pins should be less than 1000 ohms.

NOTE

Erroneous readings will be obtained in resistance measurements if the voltage between the ohmmeter probes exceeds approximately 5.0 volts dc.

Step 3. Connect a signal generator to the station antenna receptacle and adjust it to the receiver frequency. Modulate the generator output with a 1000-Hz tone at ±3.0 kHz deviation.

Step 4. Increase the signal generator output slowly until the receiver just unsquelches. Remove the modulation from the signal generator. Unsquelching should occur at a generator output that produces 6 dB noise quieting, or less.

Step 5. Measure the resistances of U202-6 and -7 with reference to ground. Both pins should be greater than 200,000 ohms.

Step 6. Increase the signal generator output until approximately 12 dB noise quieting is obtained. Remove the rf signal from the station input either by turning off the signal generator or by using a relay in series with the signal generator output. A long "squelch tail" should occur. If a calibrated, triggered sweep oscilloscope is available for measurement, the duration of the "squelch tail" should be approximately 150 milliseconds as measured at the speaker.

Step 7. Increase the signal generator output to produce 30 dB noise quieting. Turn off the rf signal and note the "squelch tail" duration. It should be no more than a "click". The duration should be less than 10 milliseconds.

Step 8. Turn the SQUELCH control fully clockwise (tight squelch).

Step 9. Adjust the signal generator output level until the station just unsquelches. Unsquelching should occur at a generator output that produces approximately 20 dB noise quieting.

3.2.2.2.2 "Private-Line" Stations

Step 1. Disable the PL circuitry.

Step 2. Perform perviously described carrier squelch station procedure.

Step 3. Return the station to PL operation. On stations using "AND" squelch operation, also turn the SQUELCH control fully counterclockwise during this test.

Step 4. Vary generator output between minimum output and 1000 microvolt output while checking the resistances of U202-6 and -7 with reference to ground. Both resistances should remain at less than 1000 ohms.

Step 5. Modulate the on-frequency generator output with a PL code for ±0.5 to ±1 kHz deviation and 1000 Hz tone for ±3.0 kHz overall deviation.

Step 6. Increase the signal generator output slowly until the receiver just unsquelches. Unsquelching should occur at a generator output that produces 6 dB quieting or less, for "PL" stations. For "DPL" stations, unsquelching should occur at a generator output that produces 8 dB quieting or less.

3.3 TROUBLESHOOTING

3.3.1 Check Input Voltages

A malfunction in the audio and squelch operation may be due to the loss of dc input voltages which can be caused by this board or another section of the station. Since there are only two input voltages applied to this board, it is advantageous to verify their presence before beginning extensive troubleshooting.

P903-1, -4	+9.6 V dc in respect to chassis
P903-16	Audio A+ (approximately +13.6 V dc in respect to A-)

In a negative ground system, audio A- is at chassis potential. In a positive ground system, audio A+ is at chassis potential.

3.3.2 Isolating Defective Components

If tests indicate abnormal performance, a logical troubleshooting procedure should be followed to isolate the defective component efficiently. Results of performance tests usually localize the malfunction to one or two stages. The accompanying troubleshooting chart summarizes these results in a logical sequence. A few waveforms, voltage and resistance checks in the suspected circuit should readily isolate the defective component when compared with those on the schematic diagram.

3.3.3 Troubleshooting Integrated Circuits

Integrated circuits (IC's) are very reliable components and should not be replaced until all checks have proven definitely that the IC is the defective component. Make sure that the external components in the circuit are normal. The IC's on the audio and squelch board may be checked by dc voltage measurements although signal tracing with an oscilloscope is preferred.

3.3.4 Stage Gain Measurements

3.3.4.1 Squelch Circuitry

3.3.4.1.1 This troubleshooting procedure may be used to isolate a squelch malfunction occuring before the detector to a specific stage. The test is performed by injecting an ac signal at the input to the squelch circuitry and noting results obtained with an ac voltmeter. Most accurate results are obtained by taking dB gain and loss measurements between points as illustrated in Figure 2. Individual point voltage checks may also be used to quickly verify proper squelch input circuitry operation but this is not an adequate test to prove the circuit is defective (refer to the following table and Figure 2). Tolerance addition may cause increasing variation from the typical readings in the table as readings are taken further from the injected signal point.

3.3.4.1.2 The following procedure may be used for loss and gain or signal level measurements while injecting a 3 kHz or 30 kHz signal. In "Private-Line" radios, PL operation will not affect this test.

Step 1. Turn the VOLUME control fully counterclockwise (off), or to a comfortable listening level, if desired.

Step 2. Turn the SQUELCH control fully clockwire (squelched) and turn the station on.

Step 3. Inject a 1000-microvolt, on-channel signal at the station antenna receptacle. This "quiets" the discriminator output and prevents erroneous test readings.

Step 4. Inject a 3 kHz, 10 millivolt rms signal at the receiver audio & squelch board at P903-9.

Step 5. Take loss and gain measurements or signal level measurements as required.

Step 6. Repeat the preceding test using a 30 kHz signal in place of the 3 kHz signal in step 4.

3.3.4.2 Audio Circuitry

AC voltage measurements and waveforms are given where applicable on the schematic diagram. Refer to this diagram for pertinent information when taking audio stage gain measurements.

AC VOLTMETER CONNECTED TO U202-PIN	AC VOLTMETER READING WITH 3 kHz SIGNAL INPUT (mV)	AC VOLTMETER READING WITH 30 kHz SIGNAL INPUT (mV)
15	2.2	6.3
1	25	70.8
2	1.4	11.2
3	16	126
4	2.8	112

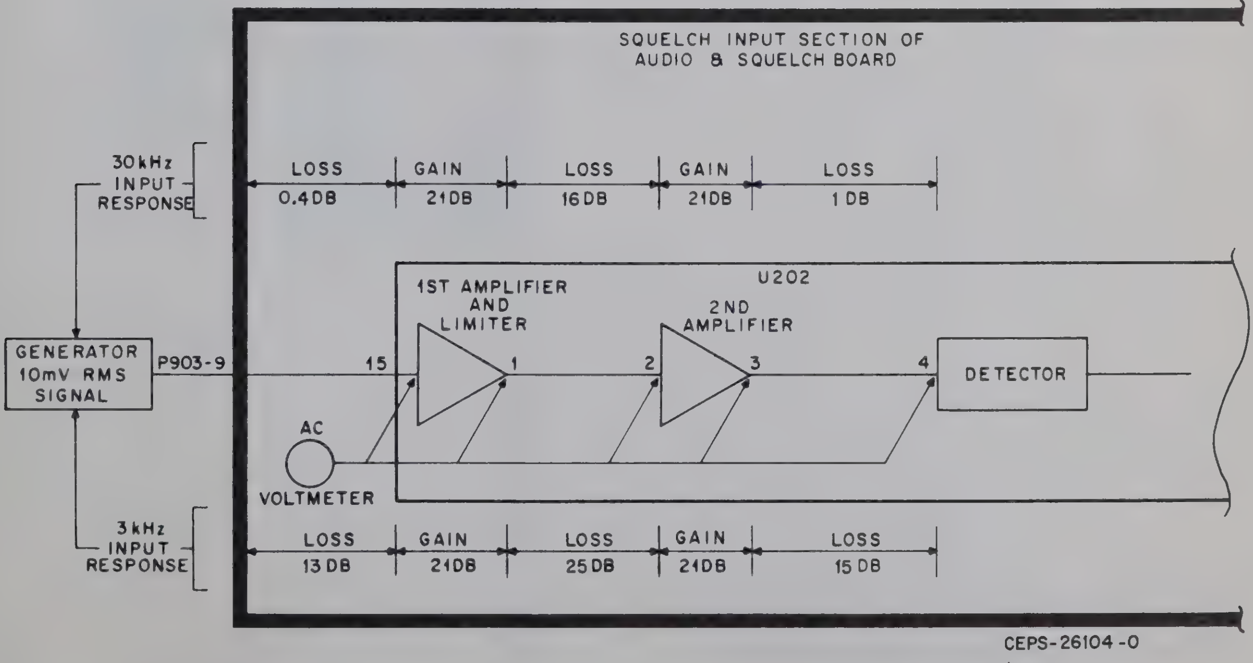
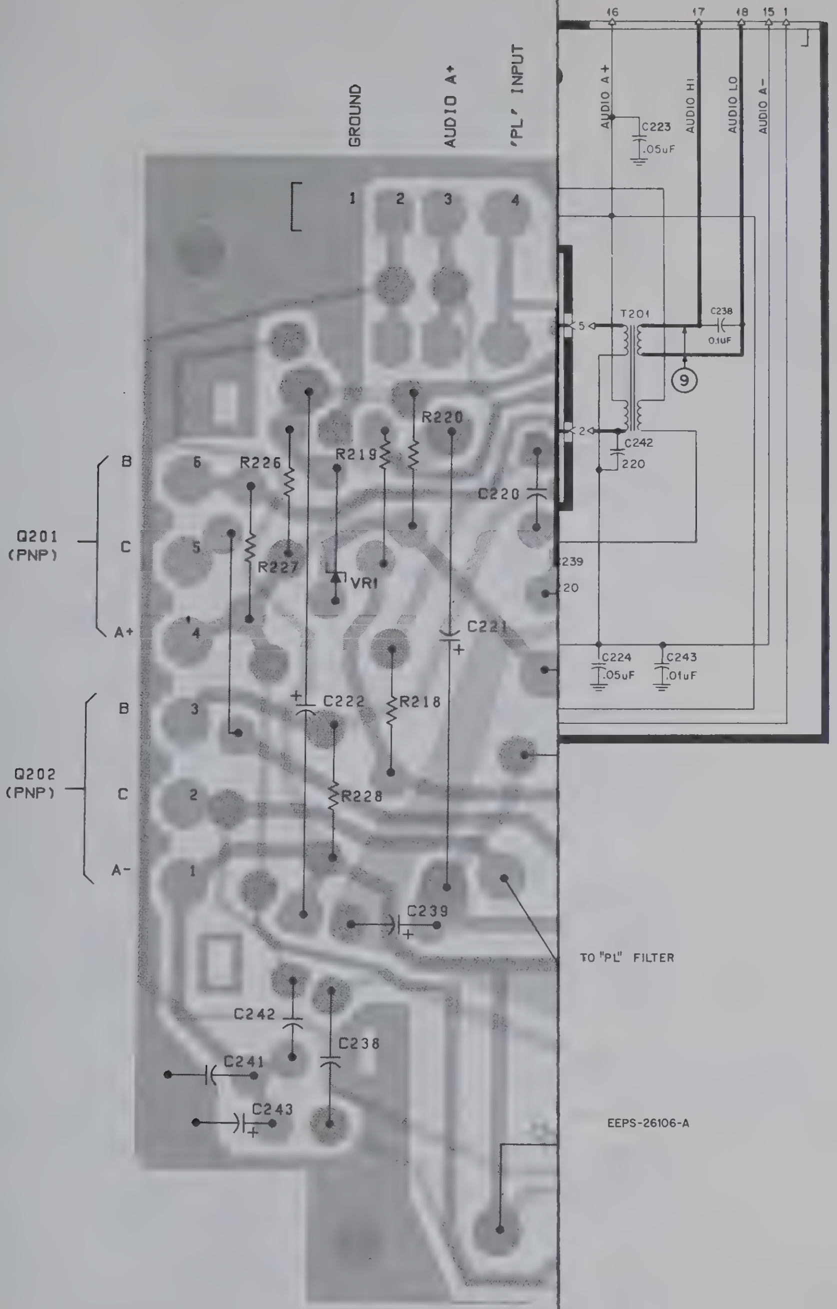

SQUELCH INPUT SECTION OF
AUDIO & SQUELCH BOARD
30kHz INPUT RESPONSE
LOSS 0.4DB
GAIN 21DB
LOSS 16DB
GAIN 21DB
LOSS 1DB
1ST AMPLIFIER AND LIMITER
U202
2ND AMPLIFIER
GENERATOR 10mV RMS SIGNAL
P903-9
15
1
2
3
4
DETECTOR
AC VOLTMETER
3kHz INPUT RESPONSE
LOSS 13DB
GAIN 21DB
LOSS 25DB
GAIN 21DB
LOSS 15DB
CEPS-26104-0

Figure 2.
Squelch Circuitry Stage Gain Measurements


16
17
18
15
1
AUDIO A+
AUDIO HI
AUDIO LO
AUDIO A-
C223
.05uF
T201
C238
0.1uF
9
5
2
C242
220
239
220
C224
.05uF
C243
.01uF
GROUND
AUDIO A+
'PL' INPUT
1
2
3
4
Q201
(PNP)
B
C
A+
6
5
4
Q202
(PNP)
B
C
A-
3
2
1
R226
R219
R220
C220
R227
VR1
C221
C222
R218
R228
C239
C242
C238
C241
C243
TO "PL" FILTER
EEPS-26106-A

NOTES:

201. +5.6 VOLTS WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH (I.E., APPROXIMATELY 6 dB QUIETING SIGNAL WITH SQUELCH CONTROL AT THRESHOLD).

202. WHERE MORE THAN ONE VOLTAGE READING APPEARS:
USQ= RECEIVER UNSQUELCHED
FSQ= RECEIVER FULLY SQUELCHED

203. VOLTAGE MEASURED WITH RESPECT TO A-.

204. VOLTAGE MEASURED WITH RESPECT TO A+.

205. VOLTAGES AT U201-6 AND -7 MUST BE THE SAME VALUE.

206. UNLESS OTHERWISE STATED:
CAPACITOR VALUES ARE IN PICOFARADS.

207. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES ±10% MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND.

208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD

209. JUMPER JU204 MUST BE REMOVED FOR "AND SQUELCH" OPERATION. (SEE "RECEIVER INTERCONNECT UNIT" SECTION). SEE JUMPER TABLE FOR JUMPER USE.

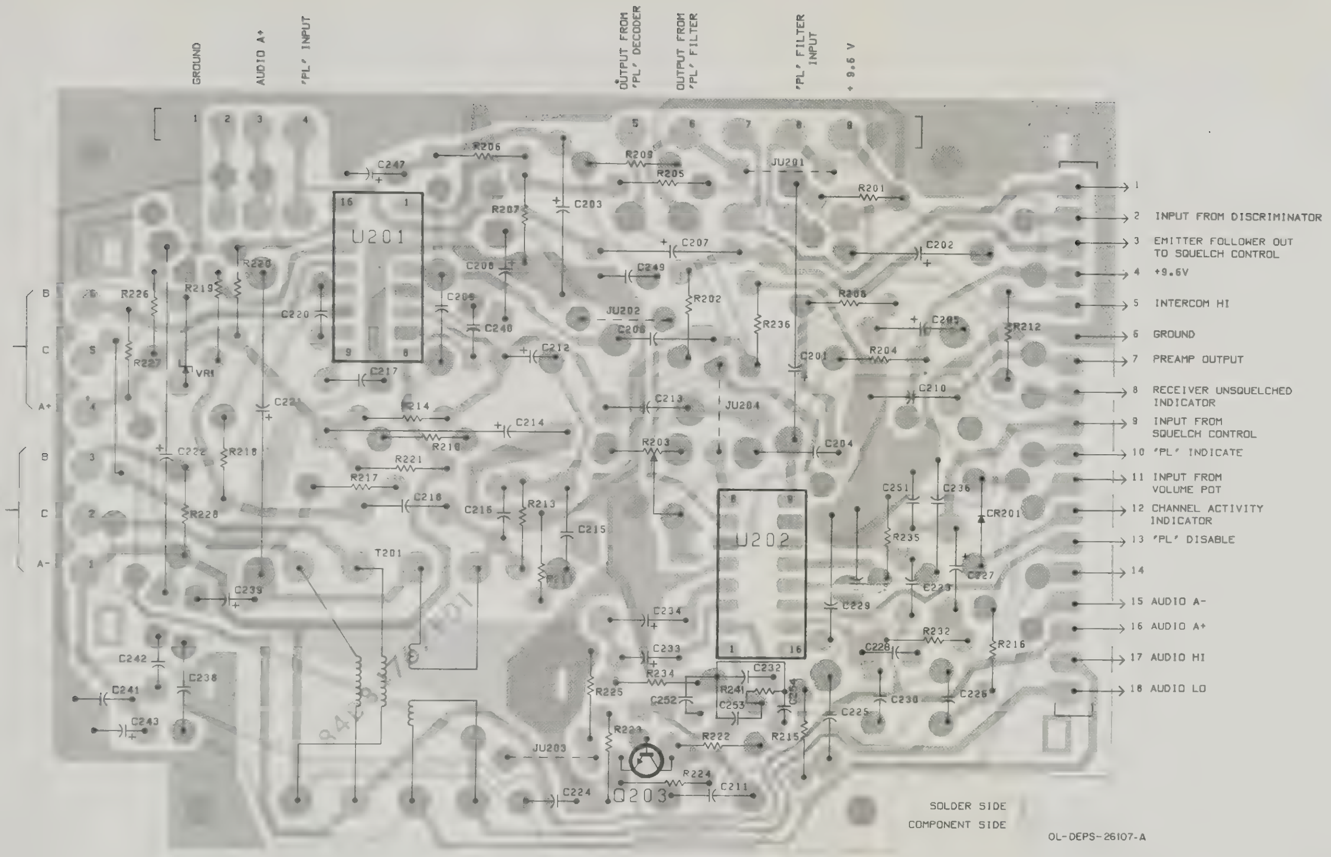
210 RED-WHITE WIRE CONNECTS TO C211-C213 JUNCTION IN ALL LOCAL CONTROL STATIONS AND IN LOCAL/REMOTE STATIONS WITH INTERCOM. IN ALL OTHER MODELS THE RED-WHITE WIRE CONNECTS TO P903-11.

JUMPER TABLE

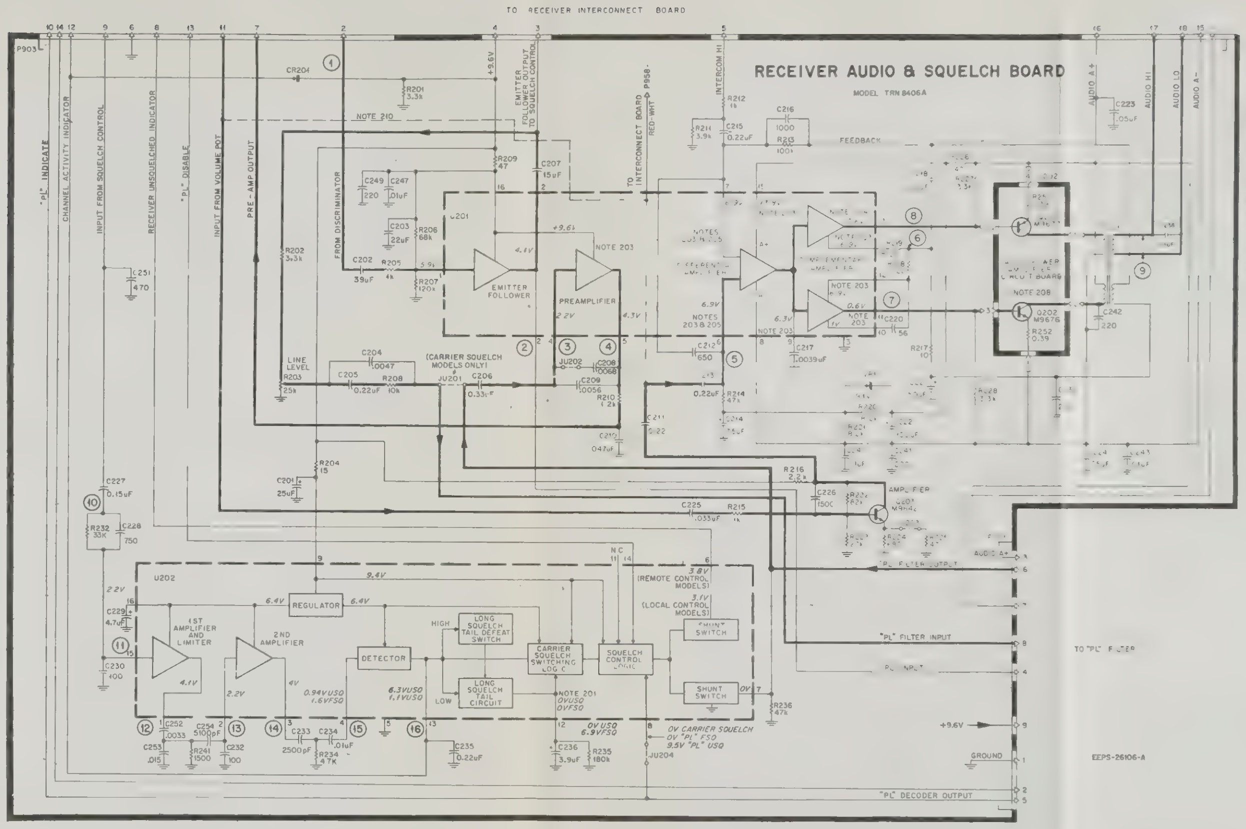
JUMPER	
JU201	CONNECTED IN CARRIER SQUELCH STATIONS AND "DIGITAL PRIVATE LINE" STATIONS
JU202	CONNECTED IN CARRIER SQUELCH STATIONS AND "DIGITAL PRIVATE LINE" STATIONS.
JU203	CONNECTED TO PROVIDE 10 WATTS AUDIO AT SPEAKER WITH LINE LEVELS OF -10dBM OR LESS (REMOTE CONTROL STATIONS ONLY).
JU204	CUT FOR "AND SQUELCH"

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TRN8406A Audio and Squelch Board
Schematic Diagram, Circuit Board Detail,
and Troubleshooting Chart
Motorola No. PEPS-26108-A
(Sheet 1 of 2)
9/1/80-UP


GROUND
AUDIO A+
"PL" INPUT
OUTPUT FROM "PL" DECODER
OUTPUT FROM "PL" FILTER
"PL" FILTER INPUT
+ 9.6 V
Q201 (PNP)
Q202 (PNP)
U201
U202
Q203
T201
1
2 INPUT FROM DISCRIMINATOR
3 EMITTER FOLLOWER OUT TO SQUELCH CONTROL
4 +9.6V
5 INTERCOM HI
6 GROUND
7 PREAMP OUTPUT
8 RECEIVER UNSQUELCHED INDICATOR
9 INPUT FROM SQUELCH CONTROL
10 "PL" INDICATE
11 INPUT FROM VOLUME POT
12 CHANNEL ACTIVITY INDICATOR
13 "PL" DISABLE
14
15 AUDIO A-
16 AUDIO A+
17 AUDIO HI
18 AUDIO LO
SOLDER SIDE
COMPONENT SIDE
OL-DEPS-26107-A

SHOWN FROM SOLDER SIDE


TO RECEIVER INTERCONNECT BOARD
RECEIVER AUDIO & SQUELCH BOARD
MODEL TRN8406A
P903
"PL" INDICATE
CHANNEL ACTIVITY INDICATOR
INPUT FROM SQUELCH CONTROL
RECEIVER UNSQUELCHED INDICATOR
"PL" DISABLE
INPUT FROM VOLUME POT
PRE-AMP OUTPUT
FROM DISCRIMINATOR
EMITTER FOLLOWER OUTPUT TO SQUELCH CONTROL
TO INTERCOM BOARD P956 RED-WHT
INTERCOM HI
AUDIO A+
AUDIO HI
AUDIO A-
FEEDBACK
EMITTER FOLLOWER
PREAMPLIFIER
LINE LEVEL
(CARRIER SQUELCH MODELS ONLY)
1ST AMPLIFIER AND LIMITER
2ND AMPLIFIER
REGULATOR
DETECTOR
LONG SQUELCH TAIL DEFEAT SWITCH
LONG SQUELCH TAIL CIRCUIT
CARRIER SQUELCH SWITCHING LOGIC
SQUELCH CONTROL
SHUNT SWITCH
(REMOTE CONTROL MODELS)
(LOCAL CONTROL MODELS)
HIGH
LOW
"PL" FILTER INPUT
"PL" FILTER OUTPUT
"PL" INPUT
"PL" DECODER OUTPUT
TO "PL" FILTER
+9.6V
GROUND
U201
U202
U204
Q202 M9676
EEPS-26106-A

[illegible]

[illegible] OPERATION (SEE RECEIVER [illegible] SECTION) SEE JUMPER TABLE FOR [illegible]

210 RED- WHITE WIRE CONNECTS TO C211-C213 JUNCTION IN ALL LOCAL CONTROL STATIONS AND IN LOCAL REMOTE STATIONS WITH INTERCOM. IN ALL OTHER MODELS THE RED- WHITE WIRE CONNECTS TO P903-11

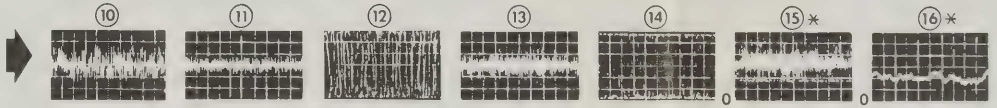
[illegible]

ALL SQUELCH CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY = 0.5 V/DIV.
2. HORIZONTAL DEFLECTION = 2 msec/DIV.
3. SQUELCH CONTROL FULLY CLOCKWISE (ON). NO EXTERNAL SIGNAL APPLIED.
*4. WAVEFORMS ⑮ AND ⑯ ARE DC COUPLED WITH ZERO AT BOTTOM, OTHERS AC COUPLED.

EPS-6534-O

SQUELCH CIRCUIT WAVEFORMS

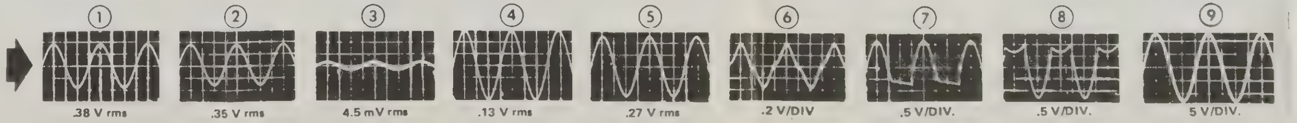


ALL AUDIO CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER THE FOLLOWING CONDITIONS

1 VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
2 HORIZONTAL DEFLECTION = 25 msec/DIV
3 SQUELCH CONTROL FULLY COUNTERCLOCKWISE (OFF) 1000 uV RF SIGNAL INPUT MODULATED WITH 1000 Hz TONE WITH +3.0 kHz DEVIATION
4. VOLUME CONTROL SET FOR 9.0 V rms AT LOAD
5 OUTPUT TERMINATED IN 8 OHM LOAD
6. R203 SET FOR 175 mV AT PIN 7 WITH +5 kHz DEVIATION (1 kHz TONE)

EPS 8804-O

AUDIO CIRCUIT WAVEFORMS



PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TRN8406A Audio and Squelch Board
Schematic Diagram, Circuit Board Detail,
and Troubleshooting Chart
Motorola No. PEPS-26108-A
(Sheet 1 of 2)
9/1/80-UP

PARTS LIST

TRN8406A Audio and Squelch Board PL-5930-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; uF; ±10%; 100 V; unl. stated
C201	23-83210A01	25 +150-10%; 25 V
C202	23-82783B36	39; 10 V
C203	23-84762H10	22 ±20%; 15 V
C204	8-83813H12	.0047
C205	8-83813H11	0.22; 75 V
C206	8-83813H29	0.33; 50 V
C207	23-82783B24	15; 25 V
C208	8-83813H01	.0068
C209	8-83813H26	.0056 ±5%; 50 V
C210	8-82905G03	.047; 50 V
C211	8-83813H11	0.22; 75 V
C212	21-848236	650 pF ±5%; 500 V
C213	8-83813H11	0.22; 75 V
C214	23-84081B03	75 +150-10%; 15 V
C215	8-83813H11	0.22; 75 V
C216	21-82187B20	1000 pF
C217	21-82187B43	.0039; 200 V
C218	8-83813H11	0.22; 75 V
C219		NOT USED
C220	21-83406D46	56 pF ±5%; 500 V; N150
C221	23-84081B01	50 +100-10%; 25 V
C222	23-83210A08	100 +150-10%; 25 V
C223, 224	21-82372C04	.05 +80-20%; 25 V
C225	8-82905G16	.033
C226	21-82187B31	1500 pF ±10%; 100 V
C227	8-83813H07	0.15; 75 V
C228	21-84494B22	750 pF ±5%
C229	23-84762H07	4.7 ±20%; 10 V
C230	21-84426B06	100 pF ±5%; 500 V
C231		NOT USED
C232	21-82133G03	100 pF ±5%; 500 V; N750
C233	21-863296	2500 pF ±2%
C234	8-83813H31	.01; 100 V
C235	8-83813H11	0.22; 75 V
C236	23-84762H08	3.9 ±20%; 15 V
C238	21-82372C01	0.1 +80-20%; 25 V
C239	21-83596E10	220 pF ±20%; 500 V
C240	21-832501	.01 +60-40%; 250 V
C241, 242	21-83596E10	220 pF ±20%; 500 V
C243	21-832501	.01 +60-40%; 250 V
C244		NOT USED
C245, 246		NOT USED
C247	21-832501	.01 +60-40%; 250 V
C249	21-83596E10	220 pF ±20%; 500 V
C251	21-84426B11	470 pF ±5%; 500 V
C252	8-82905G25	.0033
C253	8-82905G15	.015
C254	21-874354	5100 pF ±5%
		DIODE: (SEE NOTE)
CR201	48-83654H01	silicon
		CONNECTOR, plug:
P201		consists of contact pins mounted on circuit board
		TRANSISTOR: (SEE NOTE)
Q203	48-869642	NPN; type M9642
		RESISTOR, fixed: ±5%; 1/4 W; unl. stated
R201, 202	6-124A61	3.3k
R203	18-83083G24	variable: 25k ±30%
R204	6-124A05	15
R205	6-124A49	1k
R206	6-124A93	68k
R207	6-124A99	120k
R208	6-124A73	10k
R209	6-124A17	47 ±10%
R210	6-124A51	1.2k
R211	6-124A63	3.9k
R212	6-124A49	1k
R213	6-124A97	100k
R214	6-124A89	47k
R215	6-124A49	1k
R216	6-124A57	2.2k
R217	6-124A01	10
R218, 219	6-124A09	22
R220, 221	6-124A71	8.2k
R222	6-124A95	82k
R224	6-124A45	680
R225, 226	6-124A17	47
R227, 228	6-124A61	3.3k
R229 thru 231		NOT USED
R232	6-124A85	33k
R233		NOT USED
R234	6-124A65	4.7k
R235	6-124B04	180k ±10%
R236	6-124A89	47k ±10%
R240		NOT USED
R241	6-124A53	1.5k
		TRANSFORMER, AF:
T201	25-84083B02	pri: split winding; total res 0.5 Ohms max sec: res 0.8 Ohms max feedback: res 2 Ohms max
		INTEGRATED CIRCUIT: (SEE NOTE)
U201	51-82848M70	type M4870
U202	51-84267A09	type SC6709
		DIODE: (SEE NOTE)
VR1	48-82256C38	Zener; 9.1 V; 400 mW
NON-REFERENCED ITEMS		
	42-84284B01	RETAINER; 4 req'd.
	3-138162	SCREW, tapping: Phillips rd. hd., 4-40 x 3/8"; 4 req'd. (used for mounting Retainers)
	55-84300B01	HANDLE (long)
	55-84300B02	HANDLE (short)
	29-84028H01	TERMINAL, contact; 18 req'd. (long)
	29-84028H02	TERMINAL, contact; 24 req'd. (short)

NOTE: Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MOTOROLA INC.
Communications
Group

AUDIO POWER AMPLIFIER

MODEL TLN4290B

1. DESCRIPTION

The audio power amplifier provides the required power to drive an 8-ohm speaker with 10 watts of audio power, or a 16-ohm speaker with 5 watts of audio power, with less than 5% overall distortion. Two complementary power transistors (NPN and PNP types), operating class AB, with two current limiting resistors, develop this power. The audio drive from the audio and squelch board is routed to this board, amplified, and then returned to the audio and squelch board, where it is applied to the audio output transformer.

The aluminum transistor mounting plate is anodized with a thin, very tough material. This mounting plate provides excellent electrical insulation and thermal conduction properties between the transistors and the heatsink.

2. SERVICING

a. Performance Checks

Performance checks on this board consists of taking resistance readings as is done for any transistor or resistor. It should be noted, however, that many VTVM's and solid-state multimeters do not have sufficient voltage at the test probes to forward bias a transistor junction into conduction and, therefore, should not be used. An inexpensive volt-ohm meter of 1,000 to 20,000 ohms-per-volt sensitivity is sufficient for performing these checks.

NOTE

Do not insert meter test probe tips into female connectors on the board. To do so could cause damage to the connectors and result in poor electrical interconnection with the audio and squelch board.

b. Transistor Replacement

Care must be exercised to prevent damage (such as a scratch) to the mounting plate anodizing at the transistor-mounting plate interface. Should the anodizing in this area become scratched, original performance can only be restored by the use of a new anodized plate. The plate can *not* be "repaired" by the use of any type of insulating washer without a loss in thermal conduction capability.

Factory replacement transistors are supplied with pre-formed leads to properly fit onto the aluminum mounting plate and circuit board. A new nylon shoulder washer is also included.

Step 1. Apply a thin, even coat of silicon grease to the metallic area of the transistor.

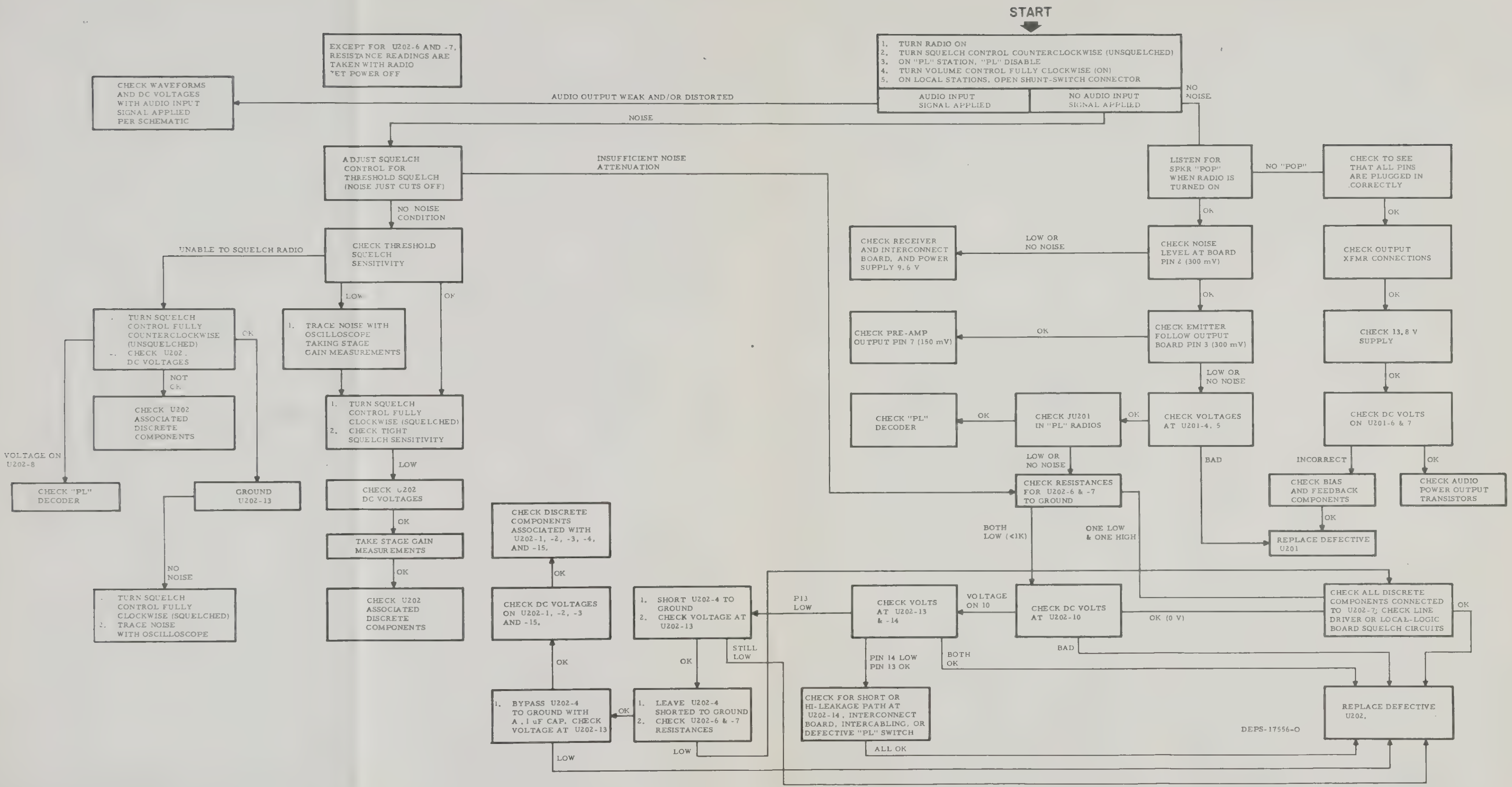
Step 2. Mount the transistor using the *new* nylon shoulder washer. Do not solder leads at this time. Tighten the transistor mounting screw.

Step 3. Solder transistor leads to printed circuit board.

TRANSISTOR RESISTANCE MEASUREMENT CHECK
(BOARD REMOVED FROM RADIO — TRANSISTORS MOUNTED ON BOARD)

Ohmmeter Connections		**Proper Resistance**	
Positive Lead Connected to	**Negative Lead Connected to**	**P-N-P Transistor**	**N-P-N Transistor**
Base	Emmitter, then Collector	Infinite	5-30 Ohms, Both Cases
Emmitter, then Collector	Base	5-30 Ohms, Both Cases	Infinite
Collector	Emitter	Infinite	Infinite
Emitter	Collector	Infinite	Infinite

Failure to obtain these results indicates a defective transistor which must be replaced.


START
1. TURN RADIO ON 2. TURN SQUELCH CONTROL COUNTERCLOCKWISE (UNSQUELCHED) 3. ON "PL" STATION, "PL" DISABLE 4. TURN VOLUME CONTROL FULLY CLOCKWISE (ON) 5. ON LOCAL STATIONS, OPEN SHUNT-SWITCH CONNECTOR
AUDIO INPUT SIGNAL APPLIED
NO AUDIO INPUT SIGNAL APPLIED
EXCEPT FOR U202-6 AND -7, RESISTANCE READINGS ARE TAKEN WITH RADIO SET POWER OFF
AUDIO OUTPUT WEAK AND/OR DISTORTED
CHECK WAVEFORMS AND DC VOLTAGES WITH AUDIO INPUT SIGNAL APPLIED PER SCHEMATIC
NOISE
NO NOISE
ADJUST SQUELCH CONTROL FOR THRESHOLD SQUELCH (NOISE JUST CUTS OFF)
INSUFFICIENT NOISE ATTENUATION
NO NOISE CONDITION
CHECK THRESHOLD SQUELCH SENSITIVITY
UNABLE TO SQUELCH RADIO
LOW
OK
1. TURN SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED) 2. CHECK U202 DC VOLTAGES
OK
NOT OK
CHECK U202 ASSOCIATED DISCRETE COMPONENTS
VOLTAGE ON U202-8
CHECK "PL" DECODER
GROUND U202-13
NO NOISE
1. TURN SQUELCH CONTROL FULLY CLOCKWISE (SQUELCHED) 2. TRACE NOISE WITH OSCILLOSCOPE
1. TRACE NOISE WITH OSCILLOSCOPE TAKING STAGE GAIN MEASUREMENTS
1. TURN SQUELCH CONTROL FULLY CLOCKWISE (SQUELCHED) 2. CHECK TIGHT SQUELCH SENSITIVITY
LOW
CHECK U202 DC VOLTAGES
OK
TAKE STAGE GAIN MEASUREMENTS
OK
CHECK U202 ASSOCIATED DISCRETE COMPONENTS
LISTEN FOR SPKR "POP" WHEN RADIO IS TURNED ON
NO "POP"
CHECK TO SEE THAT ALL PINS ARE PLUGGED IN CORRECTLY
OK
CHECK OUTPUT XFMR CONNECTIONS
OK
CHECK 13.8 V SUPPLY
OK
CHECK DC VOLTS ON U201-6 & 7
INCORRECT
OK
CHECK BIAS AND FEEDBACK COMPONENTS
CHECK AUDIO POWER OUTPUT TRANSISTORS
OK
REPLACE DEFECTIVE U201
OK
CHECK NOISE LEVEL AT BOARD PIN 2 (300 mV)
LOW OR NO NOISE
CHECK RECEIVER AND INTERCONNECT BOARD, AND POWER SUPPLY 9.6 V
OK
CHECK EMITTER FOLLOW OUTPUT BOARD PIN 3 (300 mV)
OK
CHECK PRE-AMP OUTPUT PIN 7 (150 mV)
LOW OR NO NOISE
CHECK VOLTAGES AT U201-4, 5
BAD
OK
CHECK JU201 IN "PL" RADIOS
OK
CHECK "PL" DECODER
LOW OR NO NOISE
CHECK RESISTANCES FOR U202-6 & -7 TO GROUND
BOTH LOW (<1K)
ONE LOW & ONE HIGH
CHECK DC VOLTS AT U202-10
VOLTAGE ON 10
OK (0 V)
BAD
CHECK ALL DISCRETE COMPONENTS CONNECTED TO U202-7; CHECK LINE DRIVER OR LOCAL-LOGIC BOARD SQUELCH CIRCUITS
OK
CHECK VOLTS AT U202-13 & -14
P13 LOW
PIN 14 LOW PIN 13 OK
BOTH OK
CHECK FOR SHORT OR HI-LEAKAGE PATH AT U202-14, INTERCONNECT BOARD, INTERCABLING, OR DEFECTIVE "PL" SWITCH
ALL OK
1. SHORT U202-4 TO GROUND 2. CHECK VOLTAGE AT U202-13
STILL LOW
OK
1. LEAVE U202-4 SHORTED TO GROUND 2. CHECK U202-6 & -7 RESISTANCES
LOW
OK
1. BYPASS U202-4 TO GROUND WITH A .1 uF CAP. CHECK VOLTAGE AT U202-13
LOW
OK
CHECK DC VOLTAGES ON U202-1, -2, -3 AND -15.
OK
CHECK DISCRETE COMPONENTS ASSOCIATED WITH U202-1, -2, -3, -4, AND -15.
REPLACE DEFECTIVE U202.
DEPS-17556-O

TRN8406A Audio and Squelch Board
Schematic Diagram, Circuit Board Detail
and Troubleshooting Chart
Motorola No. PEPS-26108-A
(Sheet 2 of 2)
9/1/80- UP

PARTS LIST

TRN8406A Audio and Squelch Board PL-5930-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; uF; ±10%; 100 V; unl. stated
C201	23-83210A01	25 +150-10%; 25 V
C202	23-82783B36	39; 10 V
C203	23-84762H10	22 ±20%; 15 V
C204	8-83813H12	.0047
C205	8-83813H11	0.22; [illegible] V
C206	8-83813H29	0.33; [illegible]
C207	23-82783B24	15; 25 V
C208	8-83813H01	.0068
C209	8-83813H26	.0056 ±5%; 50 V
C210	8-82905G03	.047; 50 V
C211	8-83813H11	0.22; 75 V
C212	21-848236	650 pF ±5%; 500 V
C213	8-83813H11	0.22; 75 V
C214	23-84081B03	75 +150-10%; [illegible]
C215	8-83813H11	0.22; 75 V
C216	21-82187B20	1000 pF
C217	21-82187B43	.0039; 200 V
C218	8-83813H11	0.22; 75 V
C219		NOT USED
C220	21-83406D46	56 pF ±5% [illegible]
C221	23-84081B01	50 +100-10% [illegible]
C222	23-83210A08	100 +150-10% [illegible]
C223, 224	21-82372C04	.05 +80-20%; [illegible]
C225	8-82905G16	.033
C226	21-82187B31	1500 pF ±10%; 100 V
C227	8-83813H07	0.15; 75 V
C228	21-84494B22	750 pF ±5%
C229	23-84762H07	4.7 ±20%; 10 V
C230	21-84426B06	100 pF ±[illegible]
C231		NOT USED
C232	21-82133G03	100 pF ±5%; [illegible]
C233	21-863296	2500 pF ±2%
C234	8-83813H31	.01; [illegible]
C235	8-83813H11	0.22; 75 V
C236	23-84762H08	[illegible] ±20%; 15 [illegible]
C238	21-82372C01	0.1 [illegible]
C239	21-83596E10	220 pF ±2[illegible]; 500 V
C240	21-832501	.01 +60-40%; 250 V
C241, 242	21-83596E10	220 pF ±20%; 500 V
C243	21-832501	.01 +60-40%; 250 V
C244		NOT USED
C245, 246		NOT USED
C247	21-832501	.01 +60-40%; 250 V
C249	21-83596E10	220 pF ±20%; 500 V
C251	21-84426B11	470 pF ±5%; 500 V
C252	8-82905G25	.0033
C253	8-82905G15	.015
C254	21-874354	5100 pF ±5%
		DIODE: (SEE NOTE)
CR201	48-83654H01	silicon
		CONNECTOR, plug:
P201		consists of contact pins mounted on circuit board
		TRANSISTOR: (SEE NOTE)
Q203	48-869642	NPN: type M9643
		RESISTOR, fixed: ±5%; 1/4 W; unl. stated
R201, 202	6-124A61	3.3k
R203	18-83083G24	variable: 25k ±30%
R204	6-124A05	15
R205	6-124A49	1k
R206	6-124A93	68k
R207	6-124A99	120k
R208	6-124A73	10k
R209	6-124A17	47 ±10%
R210	6-124A51	1.2k
R211	6-124A63	3.9k
R212	6-124A49	1k
R213	6-124A97	100k
R214	6-124A89	47k
R215	6-124A49	1k
R216	6-124A57	2.2k
R217	6-124A01	[illegible]
R218, 219	6-124A09	[illegible]
R220, 221	6-124A71	[illegible]
R222	6-124A95	[illegible]
R224	6-124A45	[illegible]
R22[illegible]	6-124A17	47
R22[illegible]	6-124A61	[illegible]
R2[illegible]		[illegible] USED
R23[illegible]	6-124A85	[illegible]
R23[illegible]		[illegible] USED
R2[illegible]4	6-124A65	[illegible]
R2[illegible]	6-124B04	[illegible] ±1[illegible]
R2[illegible]	6-124A89	47k ±10%
R24[illegible]		NOT USED
R241	6-124A53	1.5k
		TRANSFORMER, [illegible]
T201	25-84083B02	pri: split winding; [illegible] 0.5 Ohms max sec: res 0.8 Ohms max feedback: res 2 Ohm[illegible]
		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
		DIODE: (SEE NOTE)
VR1	48-82256C38	Zener; 9.1 V; 400 mW
[illegible] ITEMS		
	42-84284B01	RETAINER; 4 req'd.
	3-138162	SCREW, tapping: Phillips rd. hd., 4-40 x 3/8"; 4 req'd. [illegible] for mounting Retainers)
	55-84300B01	HANDLE (long)
	55-84300B02	HANDLE (short)
	29-84028H01	TERMINAL, contact; 18 req'd. (long)
	29-84028H02	TERMINAL, c[illegible] (short)

NOTE: Replacement diodes and transistors must be ordered [illegible] Motorola part number only for optimum performance.

MOTOROLA INC.
Communications
Group

AUDIO POWER AMPLIFIER

MODEL TLN4290B

1. DESCRIPTION

The audio power amplifier provides the required power to drive an 8-ohm speaker with 10 watts of audio power, or a 16-ohm speaker with 5 watts of audio power, with less than 5% overall distortion. Two complementary power transistors (NPN and PNP types), operating class AB, with two current limiting resistors, develop this power. The audio drive from the audio and squelch board is routed to this board, amplified, and then returned to the audio and squelch board, where it is applied to the audio output transformer.

The aluminum transistor mounting plate is anodized with a thin, very tough material. This mounting plate provides excellent electrical insulation and thermal conduction properties between the transistors and the heatsink.

2. SERVICING

a. Performance Checks

Performance checks on this board consists of taking resistance readings as is done for any transistor or resistor. It should be noted, however, that many VTVM's and solid-state multimeters do not have sufficient voltage at the test probes to forward bias a transistor junction into conduction and, therefore, should not be used. An inexpensive volt-ohm meter of 1,000 to 20,000 ohms-per-volt sensitivity is sufficient for performing these checks.

NOTE

Do not insert meter test probe tips into female connectors on the board. To do so could cause damage to the connectors and result in poor electrical interconnection with the audio and squelch board.

b. Transistor Replacement

Care must be exercised to prevent damage (such as a scratch) to the mounting plate anodizing at the transistor-mounting plate interface. Should the anodizing in this area become scratched, original performance can only be restored by the use of a new anodized plate. The plate can *not* be "repaired" by the use of any type of insulating washer without a loss in thermal conduction capability.

Factory replacement transistors are supplied with pre-formed leads to properly fit onto the aluminum mounting plate and circuit board. A new nylon shoulder washer is also included.

Step 1. Apply a thin, even coat of silicon grease to the metallic area of the transistor.

Step 2. Mount the transistor using the *new* nylon shoulder washer. Do not solder leads at this time. Tighten the transistor mounting screw.

Step 3. Solder transistor leads to printed circuit board.

TRANSISTOR RESISTANCE MEASUREMENT CHECK
(BOARD REMOVED FROM RADIO — TRANSISTORS MOUNTED ON BOARD)

Ohmmeter Connections		**Proper Resistance**	
Positive Lead Connected to	**Negative Lead Connected to**	**P-N-P Transistor**	**N-P-N Transistor**
Base	Emmitter, then Collector	Infinite	5-30 Ohms, Both Cases
Emmitter, then Collector	Base	5-30 Ohms, Both Cases	Infinite
Collector	Emitter	Infinite	Infinite
Emitter	Collector	Infinite	Infinite

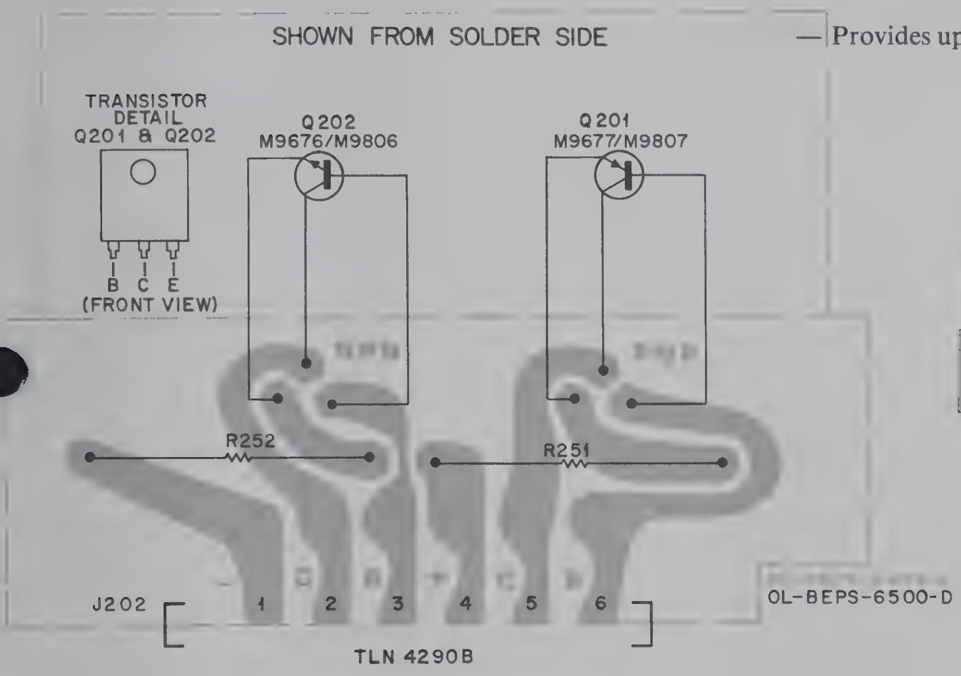
Failure to obtain these results indicates a defective transistor which must be replaced.

AUDIO POWER AMPLIFIER

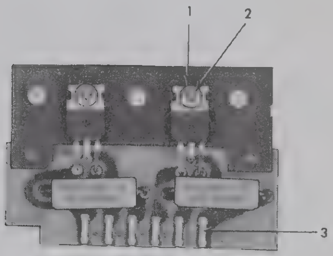
MODEL TLN4290B

FUNCTION

— Provides up to 10 watts audio output.


SHOWN FROM SOLDER SIDE
TRANSISTOR DETAIL Q201 & Q202
B C E
(FRONT VIEW)
Q202 M9676/M9806
Q201 M9677/M9807
R252
R251
J202
1
2
3
4
5
6
TLN 4290B

OL-BEPS-6500-D



FAEPS-6502-O

AUDIO POWER AMPLIFIER

TLN4290B Audio Power Amplifier PL-1061-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J202		CONNECTOR, receptacle: c/o; 9B83011H01 PIN, female; 6 req'd
		TRANSISTOR: (SEE NOTE)
Q201	48R869807 or48R869677	PNP; type M9807 PNP; type M9677
Q202	48R869806 or48R869676	NPN; type M9806 NPN type M9676
		RESISTOR, fixed: ±10%; 3 W:
R251	17D82177B49	0.39
R252	17D82177B49	0.39
MECHANICAL PARTS		
1	4B84180C01	WASHER, shoulder
2	3S129841	SCREW, machine: No. 4-40 x 1/4"; incl. lockwasher
3	9B83011H01	PIN, female

REFER
SYM

PART

This pa
Board.
applica

TLN56
Receiv

C1 thru

C951
C952, 9

CR951
954, 95

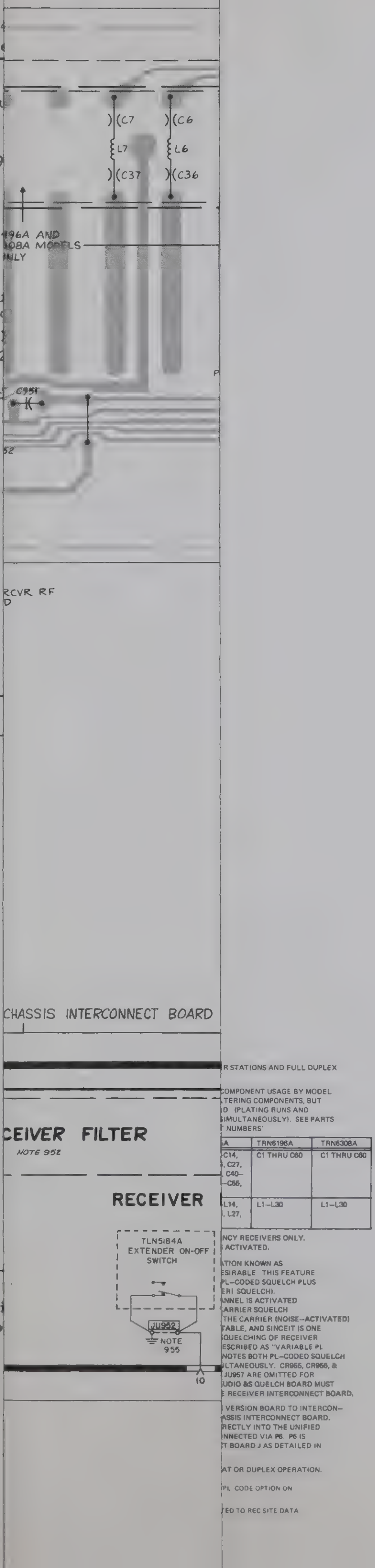
L1 thru
6 thru
12, 14,
21, 24,
L5, 10,
23, 27 t
L901

P6

P6

R951

NOTE:
For opti
by Moto


C7
L7
C37
C6
L6
C36
C954
CHASSIS INTERCONNECT BOARD
CEIVER FILTER
NOTE 952
RECEIVER
TLN5184A
EXTENDER ON-OFF
SWITCH
JU952
NOTE
955
TRN6196A
TRN6308A
C1 THRU C60
C1 THRU C60
L1–L30
L1–L30

RECEIVER INTERCONNECT BOARD

FUNCTION

Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

Receiver Interconnect Board
Schematic Diagram, Circuit Board Details, and Parts List
Motorola No. ***PEPS-18067-E***
9/1/80-UP

PARTS LIST

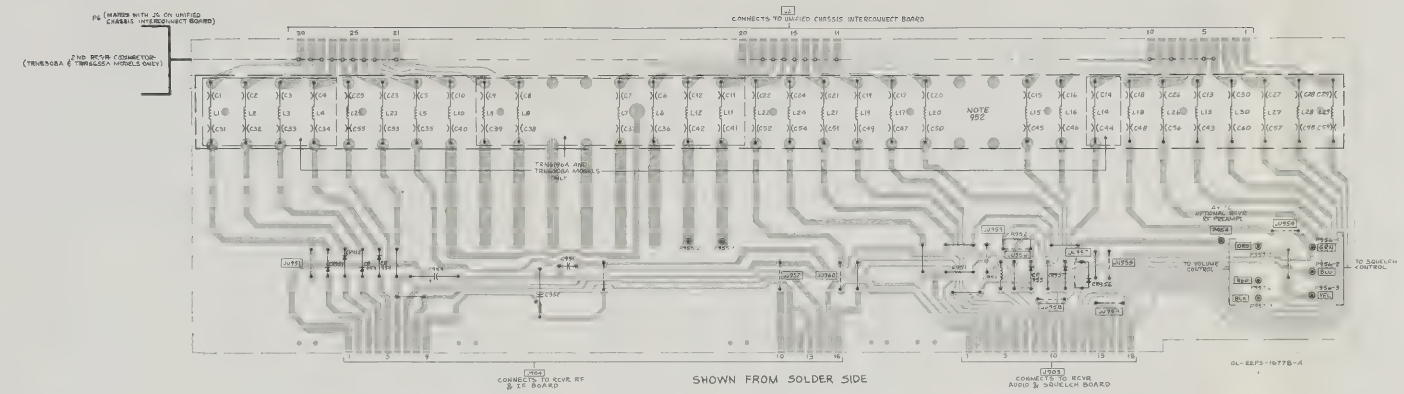
NOTE

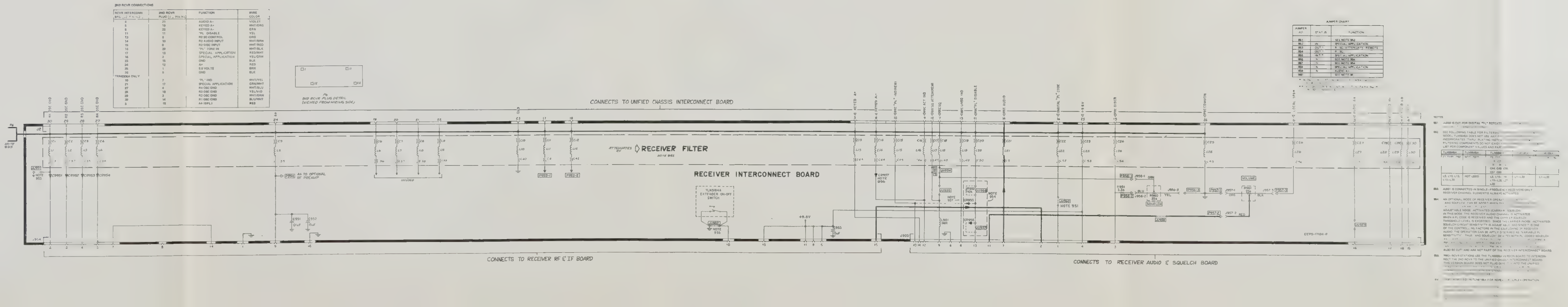
This parts list covers five models of the Receiver Interconnect Board. Where differences exist, the model number of the applicable unit is given in the Description column.

TLN5646A/TLN5648A/TLN5655A/TRN6196A/TRN6308A
Receiver Interconnect Board PL-3435-C

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed:
[illegible]	21-861219	1000 pF +100-0%; 500 V (TRN6196A & TRN6308A)
[illegible]	21-82428B59	.01 uF +80-20%; 200 V
[illegible]	23-84762H09	15 uF ±20%; 20 V
		DIODE: (SEE NOTE)
CR951 thru 954, 957	23-84762H09	silicon
		COIL, rf:
L1 thru 4, 6 thru 9, 11, 12, 14, 15 thru 21, 24, 25, 26	24-83961B01	3 turns; coded brown
[illegible] 22, 23, 27 thru 30	24-83977B01	1-1 2 turns
[illegible]	24-82549D03	1000 uH
		CONNECTOR, plug:
[illegible]	--	(TLN5655A) includes:
	14-84556B01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 14 req'd.
[illegible]	--	(TRN6308A) includes:
	14-84556B01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 20 req'd.
		RESISTOR, fixed:
[illegible]	6-124C61	3.3k ±10%; 1/4 W
		NON-REFERENCED ITEMS
	7-82626K01	BRACKET, filter
	14-82621K01	INSULATOR (TLN5648A & TLN5655)
	1-80775B75	COVER ASSEMBLY, filter (TLN5646A, TLN5655A, TRN6196A & TRN6308A) includes:
	15-82173K01	COVER, filter
	3-138162	SCREW, tapping: 4-40 x 3/8"; 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 4 used (TLN5646A, TLN5648A, TRN6196A & TRN6308A)
	42-84284B01	RETAINER, screw: 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 7 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID, 2 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID (TRN6308A)
	42-82143C03	CLAMP, cable: 1/8" ID (TLN5655A & TRN6308A)
	14-82613M02	INSULATOR

NOTE:
For optimum performance, replacement diodes must be ordered by Motorola part number.


CONNECTS TO UNIFIED CHASSIS INTERCONNECT BOARD
NOTE 952
TO VOLUME CONTROL
TO SQUELCH CONTROL
CONNECTS TO RCVR RF & IF BOARD
SHOWN FROM SOLDER SIDE
CONNECTS TO RCVR AUDIO & SQUELCH BOARD


CONNECTS TO UNIFIED CHASSIS INTERCONNECT BOARD
RECEIVER FILTER
RECEIVER INTERCONNECT BOARD
CONNECTS TO RECEIVER RF & IF BOARD
CONNECTS TO RECEIVER AUDIO & SQUELCH BOARD

RECEIVER INTERCONNECT BOARD

FUNCTION

Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

Receiver Interconnect Board
Schematic Diagram, Circuit Board Details,
and Parts List
Motorola No. ***PEPS-18067-E***
9/1/80-UP

RECEIVER INTERCONNECT BOARD

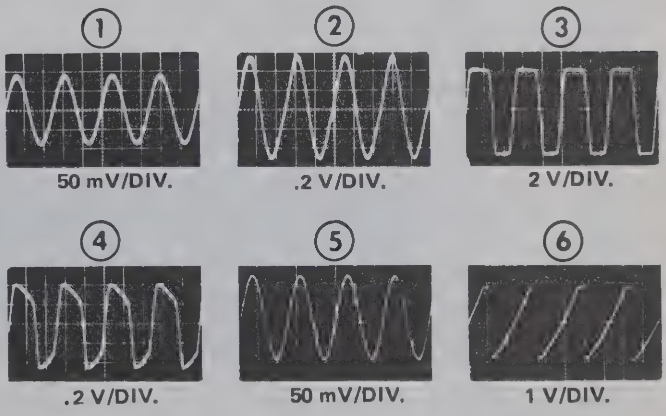
TONE “PRIVATE-LINE” DECODER

MODEL TRN8834A

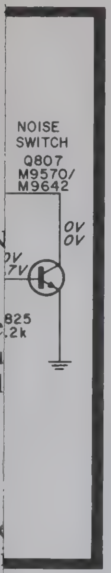
FUNCTION

Unsquelches receiver upon receipt of proper “Private-Line” tone.

“PL” DECODER WAVEFORMS



EPS-6182-B



ONDER” RESONAN

ce, the reed acts
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g. At all other frequ
d no energy is coupl

RCUIT

oper PL tone is appli
dal wave output at
soidal wave is amp
ck through C810
m. The amplified sig
ch converts the signa
f with its collector vol
plied. With tone appl
he sinusoidal wave is
lt. The positive swin
conduction of Q805
near zero volts. C813
riod and discharges th
filtered dc potential
tch Q806. With Q80
the output which
witch Q807 is also
ross the noise gate

TER

PL tone from the VC
ugh an audio filter
802 and L803. The fil
decoder but physica
This filter is high-p
he and passes the au
.

MS MEASURED UNDER FOL-
ONDITIONS:

CAL SENSITIVITY SHOWN UNDER
WAVEFORM.
ONTAL DEFLECTION = 5 msec/DIV.
RECEIVER OPERATING PROPERLY:

JECT 1000 uV RF CARRIER AT
NTENNA CONNECTOR.
ODULATE CARRIER WITH
PL” TONE. ADJUST MODULA-
ION FOR WAVEFORM ① ;
E. 60 mV rms (170 mV P-P) AT
201-2.

VER NOT USED:

JECT “PL” TONE AT J201-2.
DJUST TONE LEVEL FOR
AVEFORM ① .

LOSCOPE VERTICAL INPUT -- AC.
LOSCOPE SYNC -- INTERNAL.
UREMENTS MADE WITH RESPECT
HASSIS GROUND.

TECHNICAL CHARACTERISTICS

Frequency Determining Device	''Vibrasponder'' resonant reed
PL Tone Frequency	Selected from 67-210 Hz range
Tone Accuracy	±0.15%
Tone Bandwidth	Approximately 1 Hz
Tone Sensitivity	0.25 volt ac rms reed drive
Output	9.5 volts dc switched
Power Requirement	9.6 volts dc @15 milliamperes

1. DESCRIPTION

This decoder provides a dc output voltage to unsquelch the receiver's audio section only when the proper PL tone is received. The decoder will respond only to a specific, continuous low-frequency tone from a transmitter in the same ''Private-Line'' network.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 PL Tone Present

2.1.1.1 The PL filter passes low frequency PL tones and attenuates signals above 300 Hz. The noise switch shorts out high frequency noise signals. The tone from the PL filter is limited to a fixed level by the amplifier/clipper and then applied to the ''Vibrasponder'' resonant reed which vibrates when the tone is the same frequency as the reed's resonant frequency. When the reed is vibrating, the tone is applied to a detector which develops a dc output which activates the output switch. When the output switch is activated, 9.5 volts is present at its output to enable the audio circuits. The output also activates the noise switch.

2.1.1.2 A separate high pass audio filter is located on the PL decoder board which allows voice signals above 300 Hz to pass but blocks PL tones. This filter is connected in series with the audio signal path to prevent the PL tone from being heard in the speaker.

2.1.2 PL Tone Absent

When no PL tone is present, the output switch is off. The output voltage is 0 volts at this time which inhibits the squelch circuit to prevent an audio output to the speaker. The noise switch is off at this time which allows high frequency noise to bypass the PL filter. The presence of high frequency noise desensitizes the amplifiers and acts as an ''anti-falsing'' feature to prevent a random low-frequency noise signal from activating the resonant reed.

2.2 DECODER INPUT CIRCUITS

2.2.1 The receiver discriminator output signal consists of noise only when no carrier signal is being received. With a carrier signal input to the receiver, the noise is reduced and voice audio or voice audio and PL tone added.

2.2.2 These input signals are routed through the low pass filter and noise gate circuit. A receiver input signal that is modulated ±0.05 kHz with PL tone produces a nominal 60 millivolts rms signal at the input to the decoder. The low pass filter consisting of L801, C802, C803 and C805 attenuates sharply all signals above 300 Hz. Thus, voice and noise signals above 300 Hz are blocked but PL tones are passed. High pass filter C801, R803, and C807 presents a parallel path for high frequency noise whenever the decoder is not activated. This condition is desirable so that low frequency noise (only) will not falsely activate the decoder. When the proper tone has been received and the decoder is activated, noise switch Q807 acts as a short and grounds all high frequency signals before they reach amplifier Q801.

2.3 INPUT AMPLIFIER CIRCUITS

Amplifier Q801 amplifies noise and PL tone signals which are coupled to amplifier/clipper Q802. Diode CR801 and the base emitter junction of Q802 limit both the positive and negative swing of the signal to a maximum amplitude. The amplitude output of Q802 provides a constant amount of drive even though the amount of PL tone deviation from various transmitters is not constant. It also limits the noise signals to prevent oversensitivity to noise signals which could falsely operate the ''Vibrasponder'' resonant reed. ''Vibrasponder'' driver Q803 operates as an emitter follower to provide current drive to the low impedance ''Vibrasponder'' resonant reed.

2.4 ''VIBRASPONDER'' RESONANT REED

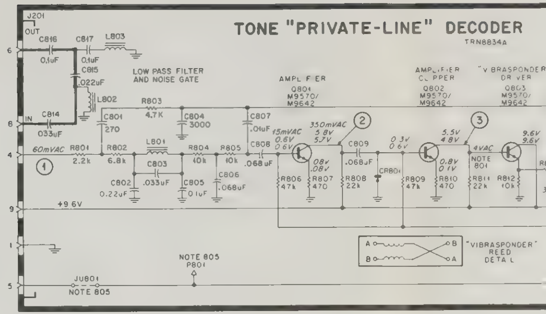
At resonance, the reed acts as a high Q transformer coupling energy from the primary to the secondary winding. At all other frequencies, the reed will not vibrate and no energy is coupled to the secondary winding.

2.5 OUTPUT CIRCUIT

When the proper PL tone is applied to the reed, it develops a sinusoidal wave output at its resonant frequency. This sinusoidal wave is amplified by Q804. Negative feedback through C810 maintains the sinusoidal waveform. The amplified signal is coupled to detector Q805 which converts the signal to a dc potential. Q805 is cut off with its collector voltage of 9.6 volts until the tone is applied. With tone applied, the positive most portion of the sinusoidal wave is clamped at approximately .6 volt. The positive swing of each cycle causes momentary conduction of Q805 and the collector voltage drops to near zero volts. C813 charges during the conduction period and discharges through R820 and R821 to develop a filtered dc potential which forward biases output switch Q806. With Q806 activated, 9.6 volts is gated to the output which unsquelches the receiver. Noise switch Q807 is also activated which places a short across the noise gate as explained in paragraph (b).

2.6 AUDIO FILTER

Audio and PL tone from the VOLUME control are routed through an audio filter consisting of C814-C817 and L802 and L803. The filter is electrically separate from the decoder but physically mounted on the same board. This filter is high-pass type which blocks the PL tone and passes the audio to the audio and squelch board.



TONE "PRIVATE-LINE" DECODER
TRN8834A
J201
OUT
IN
C816 0.1uF
C817 0.1uF
L803
C815 .022uF
L802
C814 .033uF
LOW PASS FILTER AND NOISE GATE
R803 4.7K
C801 270
C804 3000
C807 .01uF
R801 2.2k
R802 6.8k
L801
C803
R804 10k
R805 10k
C808 .068 uF
C809 .068uF
CR801
60mVAC
15mVAC
350mVAC
AMPLIFIER Q801 M9570/M9642
AMPLIFIER CLIPPER Q802 M9570/M9642
"VIBRASPONDER" DRIVER Q803 M9570/M9642
AMPLIFIER Q804 M9570/M9642
DETECTOR Q805 M9570/M9642
OUTPUT SWITCH Q806 M9570/M9642
NOISE SWITCH Q807 M9570/M9642
NOTE 801
"VIBRASPONDER" REED DETAIL
"VIBRASPONDER" RESONANT REED
+9.6V
NOTE 805
P801
JU801
R813
C810
C813
R820
R821
CR802
EEPS-30911-O

NOTES

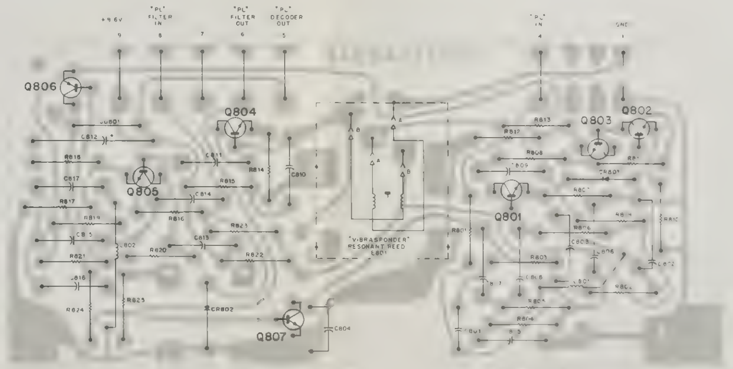
801 DUE TO SQUARE WAVE CHARACTERISTIC SOME METERS RESPOND DIFFERENTLY. VOLTAGE SHOULD BE MEASURED WITH AN OSCILLOSCOPE.

802 AC VOLTAGE READINGS ARE RMS VALUES WITH 60 MILLIVOLTS "PL" TONE INPUT USE HIGH IMPEDANCE (10 MEGOHM) AC VOLTMETER. MEASUREMENT MADE WITH RESPECT TO CHASSIS GROUND.

803. DC VOLTAGE READINGS TAKEN WITH HIGH IMPEDANCE (11 MEGOHM) DC VOLTMETER TOP VALUE IS MEASURED WITHOUT "PL" TONE BOTTOM VALUE IS MEASURED WITH 60 MILLIVOLTS "PL" TONE INPUT MEASUREMENT MADE WITH RESPECT TO CHASSIS GROUND

804 UNLESS OTHERWISE STATED
RESISTOR VALUES ARE IN OHMS,
CAPACITOR VALUES ARE IN PICOFARADS

805 JUMPER JU801 AND P801 ARE INCORPORATED IN MODEL TRN8834A ONLY. JU801 IS REMOVED AND P801 IS USED ONLY FOR CERTAIN OPTIONAL EQUIPMENT



SHOWN FROM SOLDER SIDE

TONE ''PRIVATE-LINE'' DECODER

MODEL TRN8834A

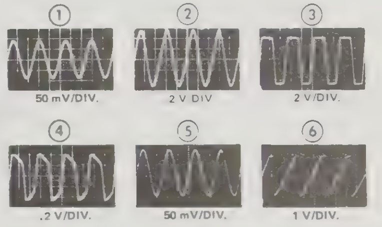
FUNCTION

Unsquelches receiver upon receipt of proper ''Private-Line'' tone.

WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS

1 VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
2 HORIZONTAL DEFLECTION = 5 msec/DIV
3 WITH RECEIVER OPERATING PROPERLY
  A INJECT 1000 uV RF CARRIER AT ANTENNA CONNECTOR
  B MODULATE CARRIER WITH "PL" TONE ADJUST MODULATION FOR WAVEFORM ①. I.E. 60 mV rms (170 mV P-P) AT J201 2
4 RECEIVER NOT USED
  A INJECT "PL" TONE AT J201 2
  B. ADJUST TONE LEVEL FOR WAVEFORM ①
5 OSCILLOSCOPE VERTICAL INPUT AC
6 OSCILLOSCOPE SYNC INTERNAL
7 MEASUREMENTS MADE WITH RESPECT TO CHASSIS GROUND.

"PL" DECODER WAVEFORMS



EPS-6182-8

Troubleshooting

If the PL decoder does not operate, or operates properly, the following hints may be helpful in cating the malfunction.

(1) Testing the "Vibrasponder" Resonant Reed

One of the first tests should be a check of e "Vibrasponder" resonant reed. Inject a 340 illivolt rms PL tone of the proper frequency directly to e primary of the reed. Use an oscilloscope or ac ltmeter to check the output across the secondary of e reed. Approximately 75 millivolts rms should be easured. If the reed is good, continue with other coder tests.

(2) Decoder Testing

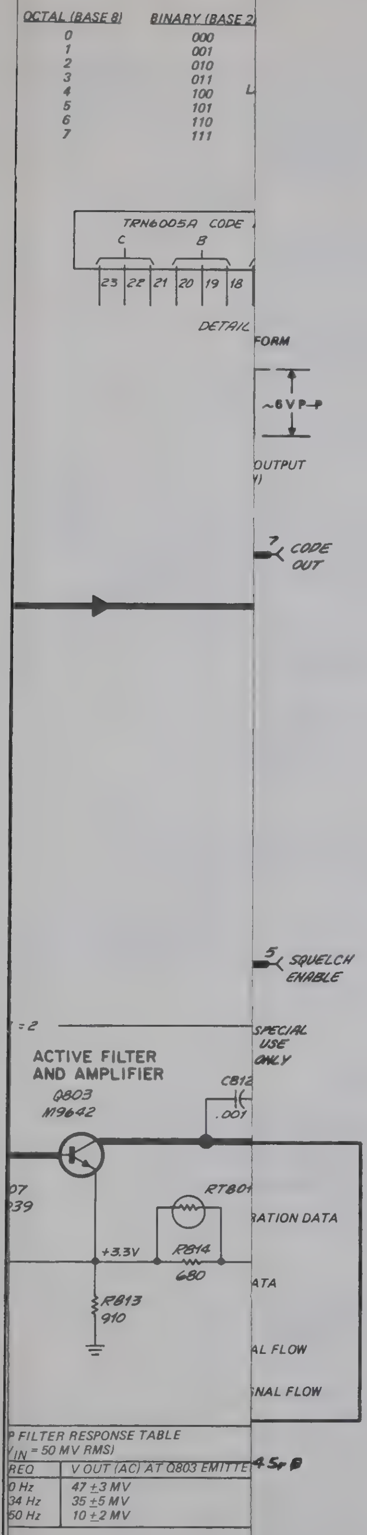
To test the decoder, inject a 1000 microvolt rrier signal into the receiver. Adjust PL modualtion r 60 millivolts rms tone signal at the input to the coder (test point 1 on the schematic diagram and cuit board detail). If the PL tone is injected directly to the decoder for testing, an rf carrier signal should injected into the receiver to quiet the receiver noise. therwise, noise and PL tone will both be present and ll produce erroneous readings.

With 60 millivolts PL tone input, measure gnal and dc voltages at various points in the decoder to olate the trouble. Typical values for a normally erating decoder are given on the schematic diagram. me waveforms are not sinusoidal and should be easured with an oscilloscope. Most ac voltmeters are librated to read accurately only for sinusoidal signals.

If under normal operating conditions, the tones are heard with the speaker audio, the high pass ter on the decoder board should be checked.

NOTE

The PL decoder can be removed from its normal position in the receiver chassis and plugged on the front or circuitry side of the audio board. Parallel-connected pins have been provided for ease of servicing. Remove the audio board shield for access to these pins.


OCTAL (BASE 8)
BINARY (BASE 2
0 000
1 001
2 010
3 011
4 100
5 101
6 110
7 111
TRN6005A CODE
C
B
23 22 21 20 19 18
DETAIL
FORM
~6 V P-P
OUTPUT
7 CODE OUT
5 SQUELCH ENABLE
SPECIAL USE ONLY
ACTIVE FILTER AND AMPLIFIER
Q803
M9642
C812
.001
RT80
+3.3V
R814
680
R813
910
ATION DATA
ATA
AL FLOW
NAL FLOW
FILTER RESPONSE TABLE
IN = 50 MV RMS)
REQ
V OUT (AC) AT Q803 EMITTE
0 Hz 47 ±3 MV
34 Hz 35 ±5 MV
50 Hz 10 ±2 MV
4.5 ± 0

"DIGITAL PRIVATE-LINE" DECODER

MODEL TLN5729A

FUNCTION

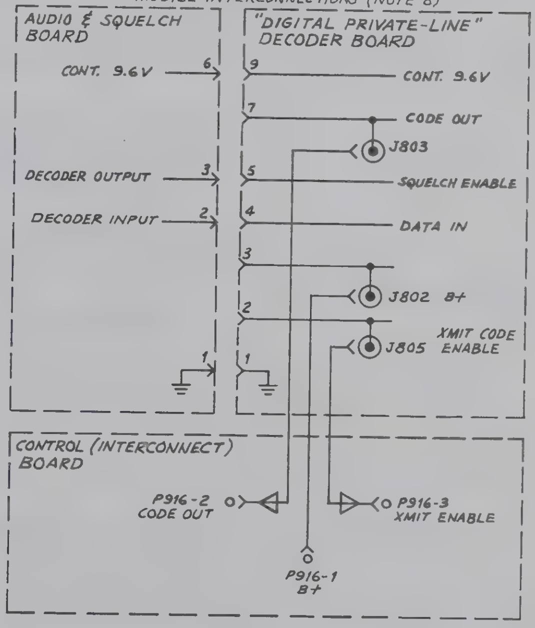
1. Decodes A 23-bit binary code word to unsquelch the receiver.
2. In radios with simplex "Digital Private-Line" operation, generates a 23-bit binary code word when the transmitter is keyed.

TECHNICAL CHARACTERISTICS

CODE DETERMINING DEVICE	TRN6005A CODE PLUG
CODE FORMAT	23-BIT WORD
CODE FREQUENCY SPECTRUM	11-67 Hz
OUTPUT	SWITCHED 5.3 V DC

DETAIL B

MOBILE INTERCONNECTIONS (NOTE 8)


AUDIO & SQUELCH BOARD
CONT. 9.6V
DECODER OUTPUT
DECODER INPUT
6
3
2
1
"DIGITAL PRIVATE-LINE" DECODER BOARD
9
7
5
4
3
2
1
CONT. 9.6V
CODE OUT
J803
SQUELCH ENABLE
DATA IN
J802 B+
J805
XMIT CODE ENABLE
CONTROL (INTERCONNECT) BOARD
P916-2 CODE OUT
P916-3 XMIT ENABLE
P916-1 B+

electrical parts list

IMPORTANT
Use **ONLY** the following Motorola part numbers when ordering replacement parts

TRN8834A Tone "Private-Line" Decoder PL 7066-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%, 50 V: unless otherwise stated
[illegible]	21-82187B38	270 pF
[illegible]	8-82905G32	0.22
[illegible]	8-82905G08	.033, 100 V
[illegible]	21-82187B26	0.003, 100 V
[illegible]	8-83813H06	0.1, 100 V
[illegible]	8-82905G04	.068, 100 V
[illegible]	8-82905G01	.01
[illegible]	8-82905G04	.068, 100 V
[illegible]	8-82905G02	.022
[illegible]	8-82905G04	.068, 100 V
[illegible]	23-83214C02	15 ± 20%, 25 V
[illegible]	8-82905G31	0.15
[illegible]	8-83293B10	.033 ± 5%
[illegible]	8-83813H16	.022 ± 5%
[illegible]	8-82905G30	0.1
[illegible]	8-82095G14	0.1 ± 5%, 200 V
[illegible]	21-83406D51	3 pF ± 0.25 pF, 500 V
		diode (see note I)
CR801, 802	48-83654H01	silicon
		"Vibrasponder" resonant reed (see note II)
[illegible]	TLN8381A	plug-in unit
		coil, rf, choke
L801, 802, 803	24-84003A01	6 H
		transistor (see note I)
Q801 thru 805	48-869642 or 48-869570	NPN, type M9642 NPN, type M9570
Q806	48-869643 or 48-869571	PNP; type M9643 PNP; type M9571
Q807	48-869642 or 48-869570	NPN, type M9642 NPN, type M9570
		resistor, fixed: ± 5%, 1/4 W unless otherwise stated
R801	6-124C57	2.2k ± 10%
R802	6-124C69	6.8k ± 10%
R803	6-124A65	4.7k
R804, 805	6-124C73	10k ± 10%
R806	6-124A89	47k
R807	6-124A41	470
R808	6-124A81	22k
R809	6-124A89	47k
R810	6-124A41	470
R811	6-124A81	22k
R812	6-124C73	10k ± 10%
R813	6-124C73	10k ± 10%
R814	6-124A31	180
R815	6-124A65	4.7k
R816	6-124A97	100k
R817	6-124A45	680
R818	6-124C25	100 ± 10%
R819	6-124A65	4.7k
R820	6-124A97	100k
R821	6-124A89	47k
R822	6-124A57	2.2k
R823	6-124A13	33
R824	6-124C73	10k ± 10%
R825	6-124C57	2.2k ± 10%

notes

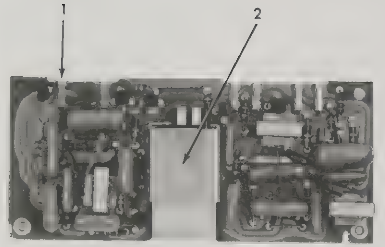
I For optimum performance, replacement diodes and transistors must be ordered by Motorola part numbers.

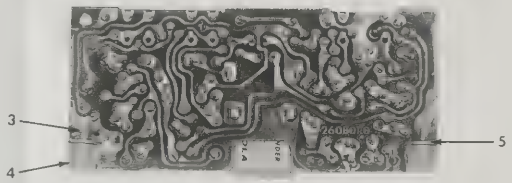
II The "Vibrasponder" Resonant Reed (Model TLN8381A) is not part of the decoder board. When ordering the complete board, the reed must be ordered separately.

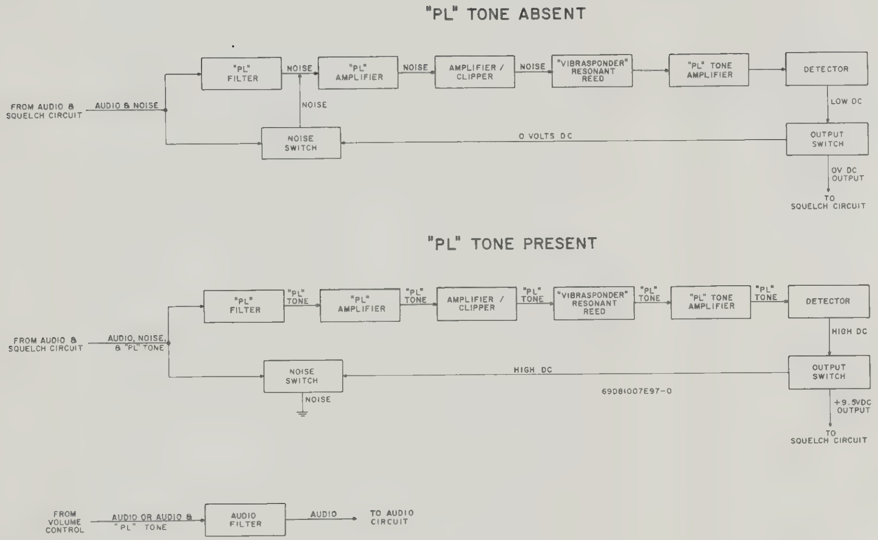
mechanical parts list

TRN8834A Tone "Private-Line" Decoder PL-7067-O

ITEM	MOTOROLA PART NO.	DESCRIPTION
1	9-83011H01	TERMINAL, pin, female, 6 req'd
2	42-84116B01	SOCKET & CLAMP ASSY
3	3-136905	SCREW, lock, No. 4 x 5/16", 2 req'd
4	42-82484B01	RETAINER, nylon, 2 req'd
5	7-84223B01	BRACKET, retainer






"PL" TONE ABSENT

"PL" TONE PRESENT

FROM AUDIO & SQUELCH CIRCUIT
AUDIO & NOISE
"PL" FILTER
NOISE
"PL" AMPLIFIER
NOISE
AMPLIFIER / CLIPPER
NOISE
"VIBRASPONDER" RESONANT REED
"PL" TONE AMPLIFIER
DETECTOR
LOW DC
NOISE
NOISE SWITCH
0 VOLTS DC
OUTPUT SWITCH
0V DC OUTPUT
TO SQUELCH CIRCUIT
FROM AUDIO & SQUELCH CIRCUIT
AUDIO, NOISE, & "PL" TONE
"PL" FILTER
"PL" TONE
"PL" AMPLIFIER
"PL" TONE
AMPLIFIER / CLIPPER
"PL" TONE
"VIBRASPONDER" RESONANT REED
"PL" TONE
"PL" TONE AMPLIFIER
"PL" TONE
DETECTOR
HIGH DC
NOISE SWITCH
HIGH DC
OUTPUT SWITCH
NOISE
69D81007E97-0
+9.5VDC OUTPUT
TO SQUELCH CIRCUIT
FROM VOLUME CONTROL
AUDIO OR AUDIO & "PL" TONE
AUDIO FILTER
AUDIO
TO AUDIO CIRCUIT

MAINTENANCE

a. Recommended Test Equipment

(1) Motorola R1010 Series RF Signal Generator. This solid-state unit provides receiver rf carrier signals.

(2) Motorola SLN6221A PL Tone Generator and "Vibrasender" resonant reed on the same frequency as the "Vibrasponder" resonant reed of the decoder. An audio signal generator may be used if it is accurately set to the decoder frequency. However, to obtain the accuracy necessary, the frequency should be adjusted while the signal is measured on a frequency counter.

(3) Motorola Solid-State Oscilloscope for tone signal measurement. Some measurements may be taken with a high impedance ac voltmeter.

(4) Motorola Solid-State DC Multimeter for dc voltage measurements.

b. Performance Tests

A 0.25 microvolt rf carrier signal modulated ±0.5 kHz with PL tone should unsquelch the receiver. This can be checked as follows:

(1) Connect the rf signal generator to the receiver rf input receptacle. Set the signal generator to the receiver carrier frequency, then set the output to minimum.

(2) Modulate the signal generator output ±0.5 kHz with a PL tone of the frequency stamped on the "Vibrasponder" resonant reed. The tone can be generated with a Motorola SLN6221A PL Tone Generator and a "Vibrasponder" resonant reed. The "Vibrasender" reed from the PL encoder may be used if it is the proper frequency.

(3) Also modulate the signal generator with an audio tone in the 300 to 3000 Hz range at ±3.3 kHz.

(4) Increase the output of the signal generator until the receiver unsquelches and the audio tone is heard on the speaker. No more than 0.25 microvolt should be required to unsquelch the receiver.

c. Troubleshooting

If the PL decoder does not operate, or operates improperly, the following hints may be helpful in locating the malfunction.

(1) Testing the "Vibrasponder" Resonant Reed

One of the first tests should be a check of the "Vibrasponder" resonant reed. Inject a 340 millivolt rms PL tone of the proper frequency directly to the primary of the reed. Use an oscilloscope or ac voltmeter to check the output across the secondary of the reed. Approximately 75 millivolts rms should be measured. If the reed is good, continue with other decoder tests.

(2) Decoder Testing

To test the decoder, inject a 1000 microvolt carrier signal into the receiver. Adjust PL modualtion for 60 millivolts rms tone signal at the input to the decoder (test point 1 on the schematic diagram and circuit board detail). If the PL tone is injected directly into the decoder for testing, an rf carrier signal should be injected into the receiver to quiet the receiver noise. Otherwise, noise and PL tone will both be present and will produce erroneous readings.

With 60 millivolts PL tone input, measure signal and dc voltages at various points in the decoder to isolate the trouble. Typical values for a normally operating decoder are given on the schematic diagram. Some waveforms are not sinusoidal and should be measured with an oscilloscope. Most ac voltmeters are calibrated to read accurately only for sinusoidal signals.

If under normal operating conditions, the PL tones are heard with the speaker audio, the high pass filter on the decoder board should be checked.

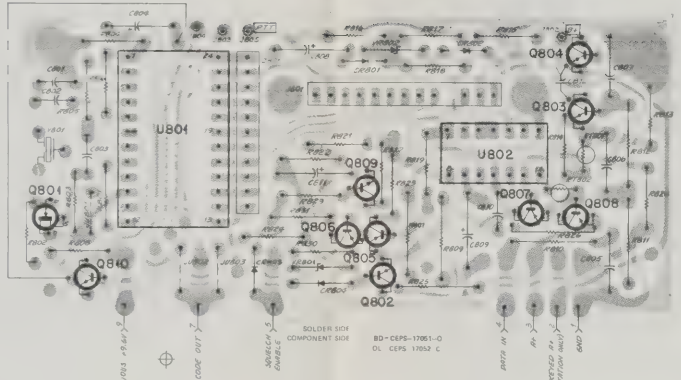
NOTE
The PL decoder can be removed from its normal position in the receiver chassis and plugged on the front or circuitry side of the audio board. Parallel-connected pins have been provided for ease of servicing. Remove the audio board shield for access to these pins.

PARTS LIST

TLN5729A Decoder Circuit Board PL-3299-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF:
C801	21-83798B01	100 pF ±5%: 200 V
C802	21-82610C22	20 pF ±5%: 200 V
C803	21-82428B56	.0047 ±10%: 100 V
C804	23-82783B08	1.0 ±20%: 35 V
C805	8-82905G39	.023 ±5%: 50 V
C806	8-83813H23	.068 ±5%: 50 V
C807	8-83813H19	.0039 ±5%: 50 V
C808, 811	23-84762H03	10 ±10%: 20 V
C809	23-82783B48	0.68 ±5%: 35 V
C810	21-82187B20	1000 pF ±10%: 100 V
		DIODE: (SEE NOTE)
CR801, 802	48-84616A01	hot carrier
CR803	48-83654H01	silicon
CR804	48-82139G01	germanium
		TRANSISTOR: (SEE NOTE)
Q801	48-869653	field-effect; type M9653
Q802	48-869649	PNP; type M9649
Q803, 809, 810	48-869642	NPN; type M9642
Q804, 805, [illegible]	48-869643	PNP; type M9643
Q808	48-869841	PNP; type M9841
		RESISTOR, fixed: ±10%: 1/4 W: unless otherwise stated
R801, 804, 831	6-124C97	100k
R802, 806	6-124D14	470k
R803	6-124C77	15k
R805	6-124D04	180k
R807, 809	6-125C25	100 :1/2 W
R808	6-124C37	330
R810, 811, 812	6-13755C64	56.2k ±1%
R813	6-124A48	910 ±5%
R814	6-124A45	680 ±5%
R815	6-124A49	1k ±5%
R816	6-124C43	560
R817, 822, 824, 830	6-124C73	10k
R818	6-124C35	270
R819	6-124C83	27k
R821	6-124A59	2.7k
R823	6-124A57	2.2k ±5%
R825	6-13755C67	5620 ±1%
R826	6-10621C59	4640 ±1%
R827, 829	6-124C83	27k
R828	6-124B10	330k ±5%
		THERMISTOR:
RT801	6-865641	300 ohm @ 25°C
RT802	6-82696B01	10k ohms @ 25°C
		INTEGRATED CIRCUIT: (SEE NOTE)
U801	51-84267A82	M6782
U802	51-84320A55	M2055
		VOLTAGE REGULATOR:
VR801	48-83696E07	Zener type; 6.2 V
VR802	48-82256C03	Zener type; 4.70 V
		CRYSTAL:
Y801	48-82003K01	resonator; 50.00000 KC
		RESISTOR NETWORK:
Z801	1-80772B36 or 51-82142K02	pull-up, 10-pin

NOTE: For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.


U801
U802
Q802
Q803
Q804
Q805
Q806
Q807
Q808
Q809
Q810
SOLDER SIDE
COMPONENT SIDE
BD-EEPS-17061-O
OL-EEPS-17062-C

SHOWN FROM COMPONENT SIDE

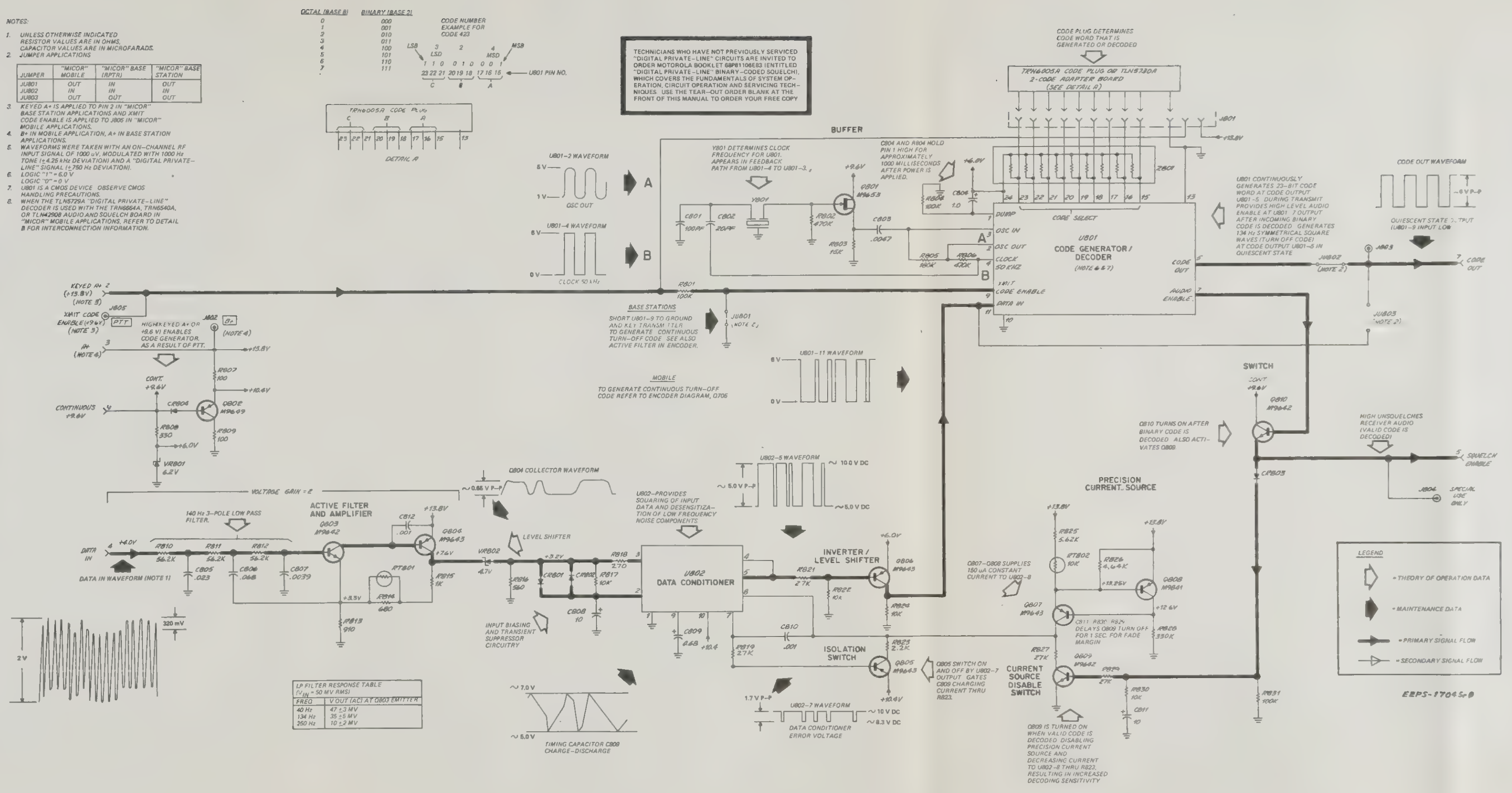
NOTES:

1. UNLESS OTHERWISE INDICATED RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN MICROFARADS.
2. JUMPER APPLICATIONS

JUMPER	"MICOR" MOBILE	"MICOR" BASE (RPTR)	"MICOR" BASE STATION
JU801	OUT	IN	OUT
JU802	IN	IN	IN
JU803	OUT	OUT	OUT

3. KEYED A+ IS APPLIED TO PIN 2 IN "MICOR" BASE STATION APPLICATIONS AND XMIT CODE ENABLE IS APPLIED TO J805 IN "MICOR" MOBILE APPLICATIONS.
4. B+ IN MOBILE APPLICATION, A+ IN BASE STATION APPLICATIONS.
5. WAVEFORMS WERE TAKEN WITH AN ON-CHANNEL RF INPUT SIGNAL OF 1000 uV, MODULATED WITH 1000 Hz TONE (±4.25 kHz DEVIATION) AND A "DIGITAL PRIVATE-LINE" SIGNAL (±750 Hz DEVIATION).
6. LOGIC "1" = 6.0 V
   LOGIC "0" = 0 V
7. U801 IS A CMOS DEVICE OBSERVE CMOS HANDLING PRECAUTIONS.
8. WHEN THE TLN5729A "DIGITAL PRIVATE-LINE" DECODER IS USED WITH THE TRN6664A, TRN6540A, OR TLN4290B AUDIO AND SQUELCH BOARD IN "MICOR" MOBILE APPLICATIONS, REFER TO DETAIL B FOR INTERCONNECTION INFORMATION.

TECHNICIANS WHO HAVE NOT PREVIOUSLY SERVICED "DIGITAL PRIVATE-LINE" CIRCUITS ARE INVITED TO ORDER MOTOROLA BOOKLET 68P81106E83 (ENTITLED "DIGITAL PRIVATE-LINE" BINARY-CODED SQUELCH), WHICH COVERS THE FUNDAMENTALS OF SYSTEM OPERATION, CIRCUIT OPERATION AND SERVICING TECHNIQUES. USE THE TEAR-OUT ORDER BLANK AT THE FRONT OF THIS MANUAL TO ORDER YOUR FREE COPY


OCTAL (BASE 8)
BINARY (BASE 2)
CODE NUMBER EXAMPLE FOR CODE 423
LSB
MSB
U801 PIN NO.
TRN6005A CODE PLUG
DETAIL A
BUFFER
CODE PLUG DETERMINES CODE WORD THAT IS GENERATED OR DECODED
TRN6005A OR TRN6005A CODE PLUG OR TLN5792A 3-CODE ADAPTER BOARD (SEE DETAIL B)
Y801 DETERMINES CLOCK FREQUENCY FOR U801.
U801-2 WAVEFORM
OSC OUT
U801-4 WAVEFORM
CLOCK 50 kHz
U801
CODE GENERATOR / DECODER
CODE SELECT
CODE OUT
CODE OUT WAVEFORM
KEYED A+ 2
XMIT CODE ENABLE
CONTINUOUS +9.6V
BASE STATIONS
MOBILE
U801-11 WAVEFORM
SWITCH
Q810 TURNS ON AFTER BINARY CODE IS DECODED.
SQUELCH ENABLE
VOLTAGE GAIN ≈ 8
DATA IN
DATA IN WAVEFORM (NOTE 5)
140 Hz 3-POLE LOW PASS FILTER
ACTIVE FILTER AND AMPLIFIER
Q804 COLLECTOR WAVEFORM
LEVEL SHIFTER
U802 PROVIDES SQUARING OF INPUT DATA AND DESENSITIZATION OF LOW FREQUENCY NOISE COMPONENTS
DATA CONDITIONER
U802
U802-8 WAVEFORM
INVERTER / LEVEL SHIFTER
ISOLATION SWITCH
PRECISION CURRENT SOURCE
CURRENT SOURCE DISABLE SWITCH
INPUT BIASING AND TRANSIENT SUPPRESSOR CIRCUITRY
LP FILTER RESPONSE TABLE
TIMING CAPACITOR C808 CHARGE-DISCHARGE
U802-7 WAVEFORM
DATA CONDITIONER ERROR VOLTAGE
LEGEND
THEORY OF OPERATION DATA
MAINTENANCE DATA
PRIMARY SIGNAL FLOW
SECONDARY SIGNAL FLOW
EEPS-17045-B

"DIGITAL PRIVATE-LINE" DECODER

MODEL TLN5729A

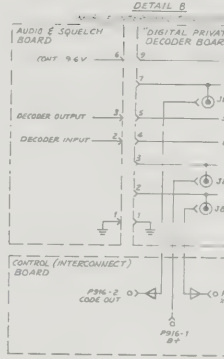
FUNCTION

1. Decodes A 23-bit binary code word to unsquelch the receiver.
2. In radios with simplex "Digital Private-Line" operation, generates a 23-bit binary code word when the transmitter is keyed.

TECHNICAL CHARACTERISTICS

CODE DETERMINING DEVICE	TRN6005A CODE PLUG
CODE FORMAT	23-BIT WORD
CODE FREQUENCY SPECTRU	
OUTPUT	SWITCHED 5.3 V D

DETAIL B


AUDIO & SQUELCH BOARD
"DIGITAL PRIVATE-LINE" DECODER BOARD
CONT 9.6V
DECODER OUTPUT
DECODER INPUT
CODE OUT
SQUELCH ENABLE
DATA IN
J802 B+
J805 XMIT CODE ENABLE
CONTROL (INTERCONNECT) BOARD
P916-2 CODE OUT
P916-3 XMIT ENABLE
P916-1 B+

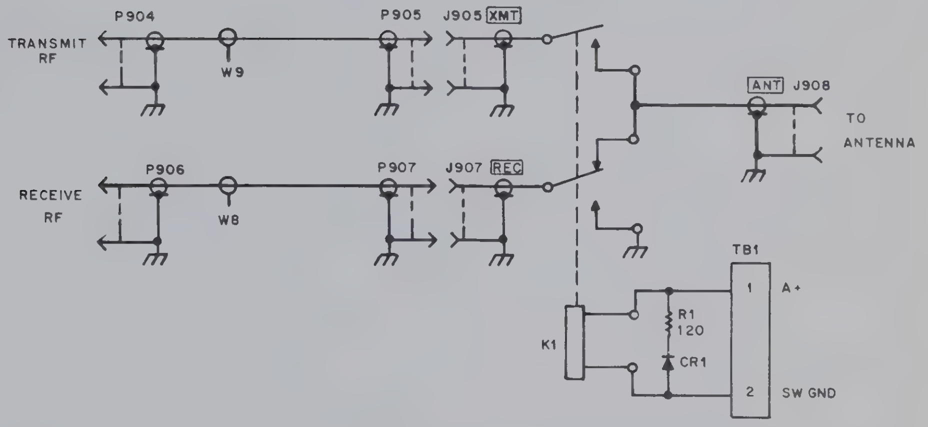
"DIGITAL PRIVATE LINE" DECODER

ANTENNA CHANGEOVER RELAY

MODEL TRN5040A, WITH BRACKET
MODEL TRN6572A, WITHOUT BRACKET

FUNCTION

The antenna changeover relay is used in base stations only. It provides switching of the antenna between the station's transmitter output and receiver input.



BEPS-33515-0

parts list

TRN5040A Antenna Changeover Relay with Bracket
TRN6572A Antenna Changeover Relay without Bracket PL-7750-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		diode: (see note)
CR1	48-82466H13	silicon
		relay, coaxial antenna:
K1	80-84654C03	13.6 V
		connector, plug:
P904, 905	28-852527	male; type "M"
P906	28-84967D01	male; type "BNC"
P907	28-852527	male; type "N"
		resistor, fixed:
R1	6-125C27	120 ± 10%; 1/2 W
		terminal board:
TB1	31-131745	strip, terminal
		wire assembly:
W8	1-80788B54	includes: ref. items P906 and P907 30-84173E01 CABLE, coaxial: 37" used (RCVR input)
W9	1-80788B55	includes: ref. items P904 and P905 30-84173E01 CABLE, coaxial: 7" used (XMTR output)
		mechanical parts
	3-7196	SCREW, machine; 4-40 x 1/8"
	3-136212	SCREW, machine; 1/4-20 x 7/8"; 4 used
	4-7667	LOCKWASHER; #4 external
	7-82792N01	BRACKET, antenna relay (TRN5040A only)
	37-82603D60	SLEEVING, black; 2 used
	39-10184A24	CONTACT, receptacle; 2 used
	42-10217A02	STRAP, tie; .091 x 3.62"; 8 used
	42-10217A10	STRAP, tie; 0.184 x 7.78"

note: For optimum performance diodes must be ordered by Motorola part numbers.

HANDLING PRECAUTIONS FOR CMOS INTEGRATED CIRCUITS

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules even in a system.

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions:

(1) Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch both hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

(2) Whenever possible avoid touching any electrically conductive parts of the circuit module with your hands.

(3) Normally, circuit modules can be inserted or removed with power applied to the unit. However, check the INSTALLATION and MAINTENANCE sections of the manual as well as the module schematic diagram to insure there are no objections to this practice.

(4) When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

(5) All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

(6) If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through a resistance of approximately 100k.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

(7) When soldering, be sure the soldering iron is grounded.

(8) Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

(9) When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

(10) All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

(11) Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). NEVER USE NONCONDUCTIVE MATERIAL for packaging these modules.

"DIGITAL PRIVATE-LINE" DECODER BOARD
TROUBLESHOOTING CHART

NOTES:

1. To obtain a test code for the following procedure apply a carrier frequency signal to the receiver rf input from an rf signal generator modulated by the code output of a Motorola SLN6413A "Digital Private-Line" Test Set. Be sure the signal generator is able to accept very low frequency modulation (less than ±5 Hz).
2. Before you replace U801, use the following procedure to verify that U801 is malfunctioning:
   a. Connect U801-11 to the code input of a Motorola SLN6413A "Digital Private-Line" Test Set.
   b. Apply a carrier-frequency signal to the receiver rf input from a signal generator that is modulated by the code output of the test set.
   If proper decode is indicated, U801 must be replaced. If U801 must be replaced, refer to the CMOS handling precautions.

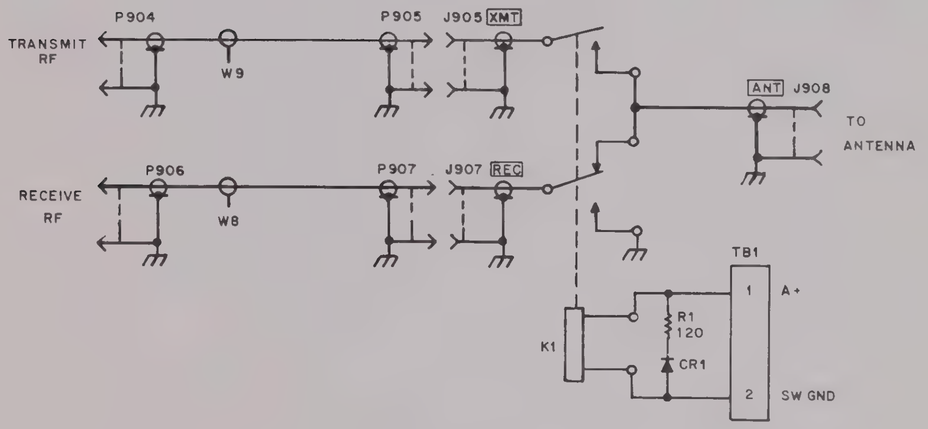
SYMPTOM	PROBABLE CAUSE	ACTION
No decode, but received audio is good when PL is disabled.	1. Audio squelch is malfunctioning.	Remove the decoder board. Apply +9.6 V at P201-3 on audio & squelch board. If audio is not enabled, troubleshoot audio & squelch circuits.
	2. No 50 kHz clock	Check U801-4 for 50 kHz clock pulses. Rise time must be ≤750 n sec.
	3. Audio enable switch is malfunctioning.	If U801-7 is high, but circuit board pin 5 is low when receiving code, replace Q810.
	4. Dump pin U801-1 is always high.	Check U801-1 should always be 0 V.
	5. Wrong or bad code plug.	Replace with a known good code plug. Check U801-15 through U801-23 for proper octal code.
	6. No data into U801.	Check U801-11 for 0 - 6 V pulses. If pulses are not present, check Q806 and U802 operation.
	7. Transmit code enable input is high.	Ground U801-9. If a received code is properly decoded, check for a malfunction in the delayed transmit enable circuit on the encoder board.
	8. U801 has an internal malfunction.	If, after checking causes 1 through 7, the cause of the problem has not been isolated, replace U801. CAUTION U801 is a CMOS device and may be damaged by improper handling. Refer to the CMOS handling precautions in this instruction section.
Excessive decoder falsing when monitoring an inactive channel (noise falsing).	1. Precision current source is low or inoperative.	Measure the dc voltages in the precision current source circuits. Current to U801-8 = (V_{BE} of Q808) (R825 + R826 +RT802)/ R826 (R825 + RT802)
	2. Current source disable switch is always on.	Check for 8 - 10 V at Q809 collector. If Q809 collector is 0 V, replace Q809.
	3. Improper 140 Hz low pass filter response.	Check dc voltages in filter circuit. Check the filter frequency response. Measured at Q803 emitter, the filter response should be -1.0 to -4.0 dB at 134 Hz and -12 to -15 dB at 250 Hz with 50 mV rms signal at decoder input.
	4. U802 supply voltage is too high.	Check U802-10 for +10.4 V ±0.2 V dc. If voltage is high, troubleshoot the +10.4 V regulator on the decoder board.
Excessive squelch tails (approx. 500 msec noise burst) at ends of received transmissions	1. Turn-off code not being transmitted by other radio unit.	Monitor circuit board pin 4 (DATA IN) for presence of turn-off code at ends of transmissions.
	2. U802 lock-in malfunction	Ground Q809 collector. With a 300 mV p-p signal at circuit board pin 4 (DATA IN), the waveform at U802-4 should be locked in to the input signal up to at least 175 Hz. If proper lock-in does not occur, replace C809, then check lock-in again. If lock-in is still bad, replace U802.
	3. U801 turn-off code detector is malfunctioning.	Check U801 (Note 2).
Poor detector sensitivity in poor quieting conditions	1. Improper 140 Hz low pass filter response response.	Check dc voltages in filter circuit. Check the filter frequency response; measured at Q803 emitter, the filter response should be -1.0 to -4.0 dB at 134 Hz and -12 to -15 dB at 250 Hz with 50 mV rms signal at decoder input.
	2. Precision current source supplying too much current to U802-8.	Measure the dc voltages in the current source circuits. Current to U802-8 = (V_{BE} of Q808) (R825 + R826 + RT802) R826 (R825 + RT802)
	3. Current source disable switch inoperative.	While detecting a valid code, check Q809 collector for 0 V dc. If 8-10 V is present, replace Q809.
Occassional squelch tail about 1 second after the end of a transmission from another radio	Current source disable switch is staying on too long.	Check Q809 collector. Q809 collector should go from 0 V dc to 8-10 V within 1.5 seconds after loss of audio squelch disable.

ANTENNA CHANGEOVER RELAY

MODEL TRN5040A, WITH BRACKET
MODEL TRN6572A, WITHOUT BRACKET

FUNCTION

The antenna changeover relay is used in base stations only. It provides switching of the antenna between the station's transmitter output and receiver input.



BEPS-33515-0

parts list

TRN5040A Antenna Changeover Relay with Bracket
TRN6572A Antenna Changeover Relay without Bracket PL-7750-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		diode: (see note)
CR1	48-82466H13	silicon
		relay, coaxial antenna:
K1	80-84654C03	13.6 V
		connector, plug:
P904, 905	28-852527	male; type "M"
P906	28-84967D01	male; type "BNC"
P907	28-852527	male; type "N"
		resistor, fixed:
R1	6-125C27	120 ± 10%; 1/2 W
		terminal board:
TB1	31-131745	strip, terminal
		wire assembly:
W8	1-80788B54	includes: ref. items P906 and P907 30-84173E01 CABLE, coaxial: 37" used (RCVR input)
W9	1-80788B55	includes: ref. items P904 and P905 30-84173E01 CABLE, coaxial: 7" used (XMTR output)
		mechanical parts
	3-7196	SCREW, machine; 4-40 x 1/8"
	3-136212	SCREW, machine; 1/4-20 x 7/8"; 4 used
	4-7667	LOCKWASHER; #4 external
	7-82792N01	BRACKET, antenna relay (TRN5040A only)
	37-82603D60	SLEEVING, black; 2 used
	39-10184A24	CONTACT, receptacle; 2 used
	42-10217A02	STRAP, tie; .091 x 3.62"; 8 used
	42-10217A10	STRAP, tie; 0.184 x 7.78"

note: For optimum performance diodes must be ordered by Motorola part numbers.

Motorola No. PEPS-33548-A
12/1/82-UP

HIGH VOLTAGE POWER SUPPLY

MODEL TPN1147A

1. DESCRIPTION

This power supply produces various dc voltages which are used to operate a vacuum tube type high power rf amplifier for the transmitter and ac voltages which are used to drive the companion TPN1148A Low Voltage Power Supply. The voltages produced for operation of the power amplifier are:

- -- 1500 V dc plate voltage
- -- 50 V dc bias voltage

The power supply uses a constant voltage ferroresonant transformer to provide the basic operating voltages to the rectification circuits. This transformer maintains the output voltages within ±3% with a ±20% change in input line voltage.

CAUTION

The input power must maintain an operating frequency to within ±3 Hz in order to keep within the regulation characteristics of the transformer.

The power supply contains an interlock protection circuit which prevents high voltages from being produced unless the station interlocks are enabled (closed).

WARNING - HIGH VOLTAGE

Extreme care must be exercised when servicing this equipment. Do not defeat interlock switches. It is a good practice to assume that HIGH VOLTAGES are present at all times, even after the ac input power is removed from the station.

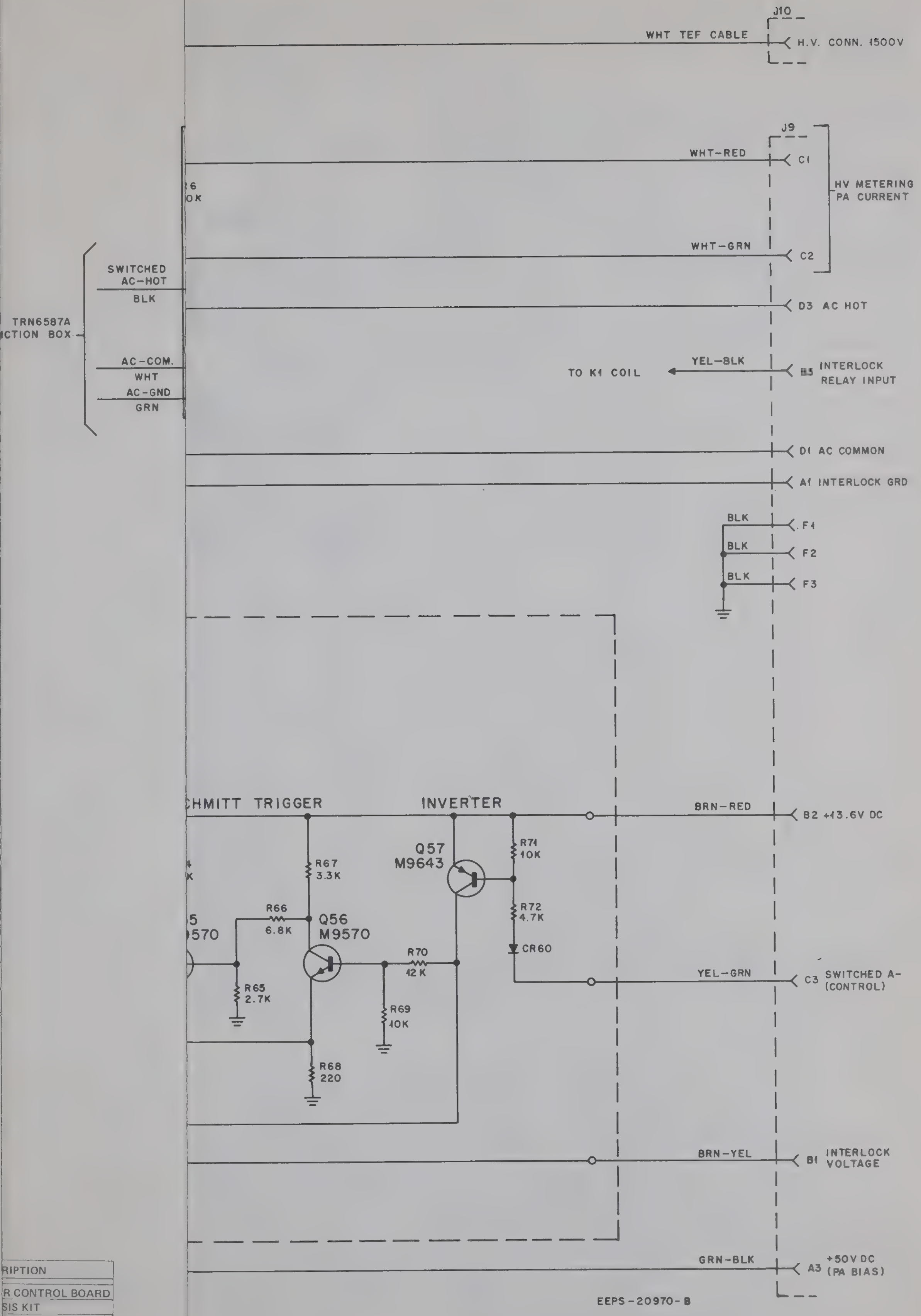
2. FUNCTIONAL OPERATION

The ac input to the power supply is routed through TB1 and F1 to T1 and T2. Two voltages are produced by half-wave rectification; the +50 V dc PA tube bias and the station safety interlock voltage. The interlock voltage is routed through the interlock switches and back to the power supply to energize K1. AC power is applied through the closed contacts of K1 to T1. The multiple winding secondary of T1 provides voltages to power the full wave rectifier network for the +1500 V dc and the companion low voltage power supply.

The filament control input to the filament regulator board through TB1-4 is enabled as follows. The transmitter turn-on switched A-function (C3) is applied through Q57 to Schmitt trigger Q56 and Q55. The Schmitt Trigger sets bistable multivibrator Q54 and Q53 so that Q53 is cut off and Q54 is turned on. The high at the collector of Q53 causes switch Q52 to turn on and create a current path through TB1-4 to the filament control input (see paragraph 2. 3 in section 68P81031E53.

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196


J10
WHT TEF CABLE
H.V. CONN. 1500V
J9
WHT-RED
C1
HV METERING
PA CURRENT
WHT-GRN
C2
6
0K
SWITCHED
AC-HOT
BLK
D3 AC HOT
TRN6587A
ICTION BOX
TO K1 COIL
YEL-BLK
B3
INTERLOCK
RELAY INPUT
AC-COM.
WHT
AC-GND
GRN
D1 AC COMMON
A1 INTERLOCK GRD
BLK
F1
BLK
F2
BLK
F3
CHMITT TRIGGER
INVERTER
BRN-RED
B2 +13.6V DC
Q57
M9643
R71
10K
R67
3.3K
R72
4.7K
R66
6.8K
5
570
Q56
M9570
R70
12 K
CR60
YEL-GRN
C3
SWITCHED A-
(CONTROL)
R65
2.7K
R69
10K
R68
220
BRN-YEL
B1
INTERLOCK
VOLTAGE
GRN-BLK
A3
+50V DC
(PA BIAS)
EEPS-20970-B

RIPTION
R CONTROL BOARD
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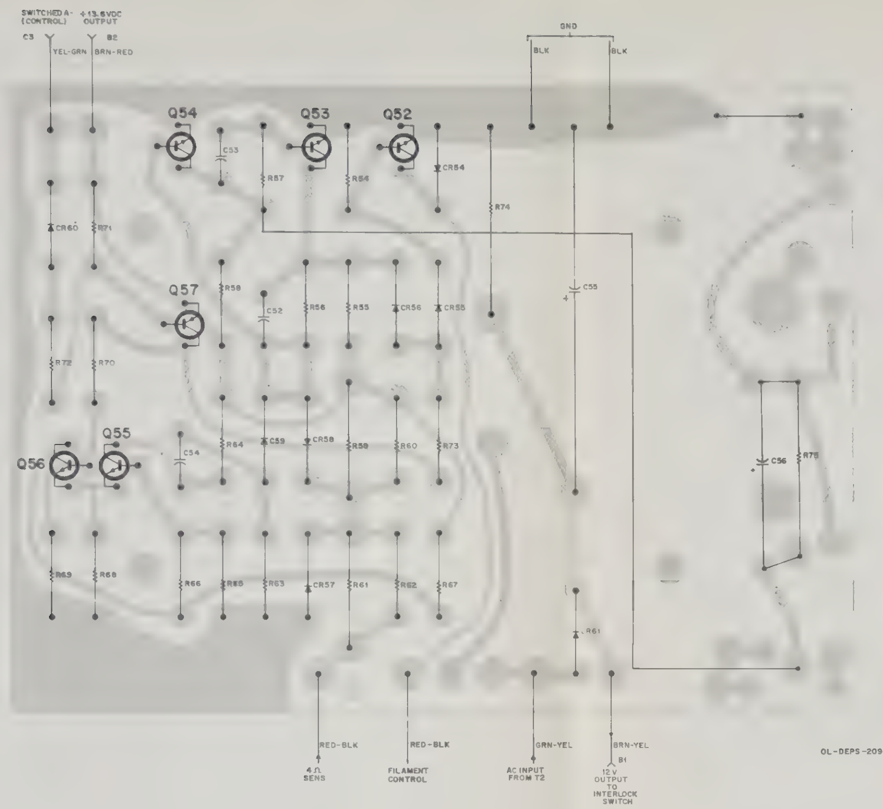
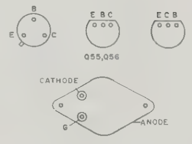
EPS-22427 O

HIGH VOLTAGE POWER SUPPLY

TPN1147A High Voltage Power Supply
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-20971-C
9/1/80-UP


SWITCHED A- (CONTROL)
+13.6VDC OUTPUT
C3
B2
YEL-GRN
BRN-RED
GND
BLK
BLK
Q54
Q53
Q52
C53
R57
R54
CR54
R74
CR60
R71
Q57
R58
C52
R56
R55
CR56
CR55
C55
R72
R70
Q56
Q55
C54
R64
C59
CR58
R59
R60
R73
C56
R75
R69
R68
R66
R65
R63
CR57
R61
R62
R67
R61
RED-BLK
4Ω SENS
RED-BLK
FILAMENT CONTROL
GRN-YEL
AC INPUT FROM T2
BRN-YEL
B1
12 V OUTPUT TO INTERLOCK SWITCH
OL-DEPS-20969-A

SHOWN FROM COMPONENT SIDE

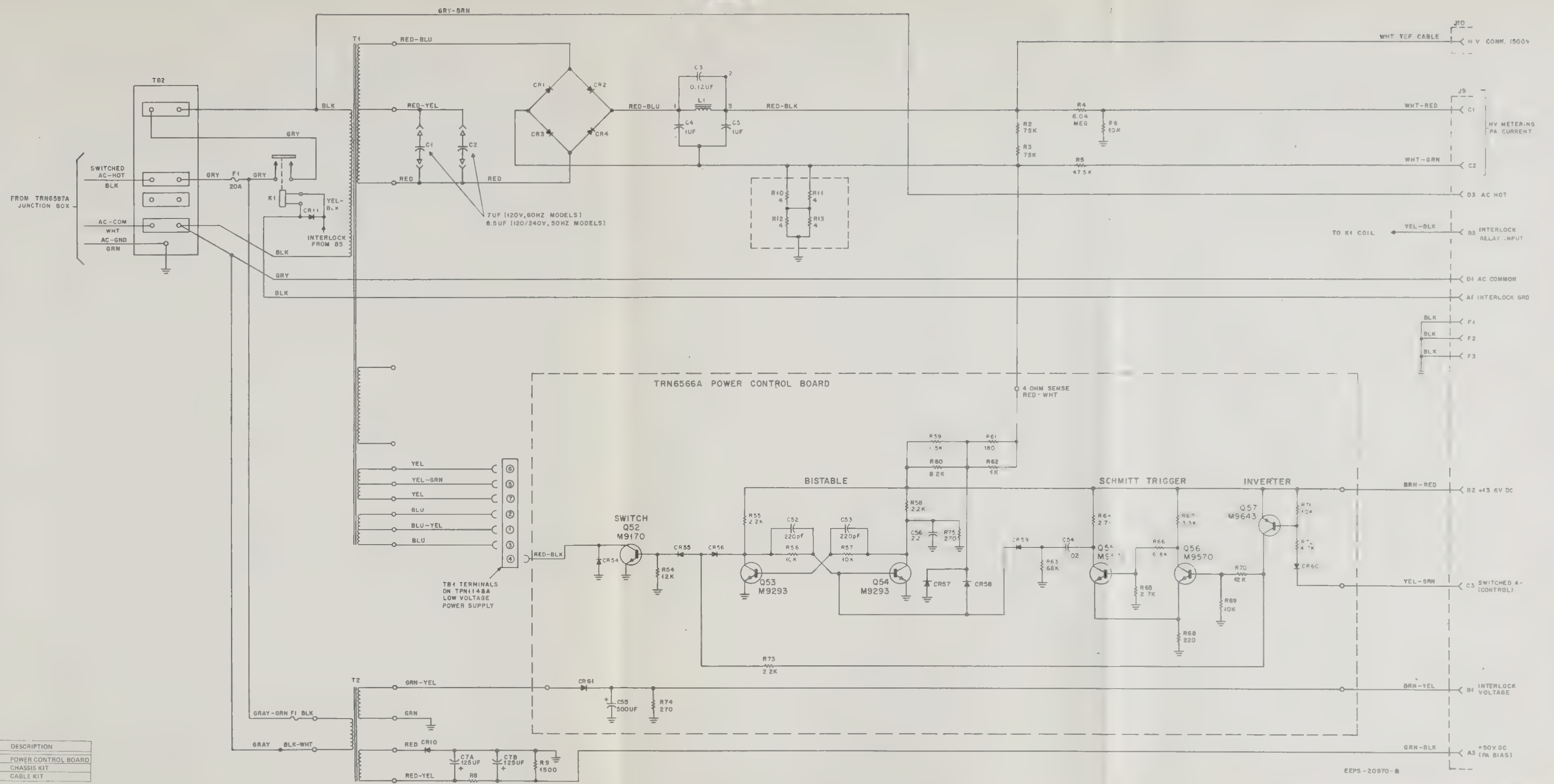

B
E
C
E B C
E C B
Q55,Q56
CATHODE
G
ANODE

BASE DETAILS
(PIN SIDE)

MODEL CHART

MODEL	SUFFIX	ITEM	SUFFIX	DESCRIPTION
TPN1147A		TRN6566A	1	POWER CONTROL BOARD
		TRN6567A		CHASSIS KIT
		TKN6840A		CABLE KIT

EPS 22427 O


GRY-BRN
T1
RED-BLU
TB2
BLK
GRY
RED-YEL
C1
C2
CR1
CR2
CR3
CR4
RED-BLU
C3
0.12UF
L1
C4
1UF
C5
1UF
RED-BLK
RED
RED
SWITCHED AC-HOT
BLK
GRY
F1
20A
K1
YEL-BLK
CR11
FROM TRN6587A JUNCTION BOX
AC-COM
WHT
AC-GND
GRN
INTERLOCK FROM B5
7UF (120V, 60HZ MODELS)
6.5UF (120/240V, 50HZ MODELS)
R10 4
R11 4
R12 4
R13 4
BLK
GRY
BLK
J10
WHT TEF CABLE
H V CONN. (500V
J9
R4
6.04 MEG
R6
10K
R2
75K
R3
75K
R5
47.5K
WHT-RED
C1
HV METERING PA CURRENT
WHT-GRN
C2
D3 AC HOT
TO K1 COIL
YEL-BLK
B5 INTERLOCK RELAY INPUT
D1 AC COMMON
A1 INTERLOCK GRD
BLK
F1
BLK
F2
BLK
F3
TRN6566A POWER CONTROL BOARD
4 OHM SENSE RED-WHT
YEL
YEL-GRN
YEL
BLU
BLU-YEL
BLU
6
8
7
2
1
3
4
RED-BLK
TB1 TERMINALS ON TPN1148A LOW VOLTAGE POWER SUPPLY
SWITCH
Q52
M9170
CR54
R54
12K
CR55
CR56
BISTABLE
R55
2.2K
C52
220pF
R56
10K
C53
220pF
R57
10K
Q53
M9293
Q54
M9293
R59
1.5K
R61
180
R60
8.2K
R62
1K
R58
2.2K
C56
2.2
R75
270
CR57
CR58
R73
2.2K
SCHMITT TRIGGER
INVERTER
CR59
R63
68K
C54
.02
R64
2.7K
Q55
R66
6.8K
R67
3.3K
Q56
M9570
R65
2.7K
R68
220
R69
10K
R70
12K
Q57
M9643
R71
10K
R72
4.7K
CR60
BRN-RED
B2 +13.6V DC
YEL-GRN
C3 SWITCHED A- (CONTROL)
T2
GRN-YEL
CR61
C55
500UF
R74
270
GRN
GRAY-GRN F1 BLK
GRAY
BLK-WHT
RED
CR10
C7A
125UF
C7B
125UF
R9
1500
RED-YEL
R8
47
BRN-YEL
B1 INTERLOCK VOLTAGE
GRN-BLK
A3 +50V DC (PA BIAS)
EEPS-20970-B

TPN1147A High Voltage Power Supply
Schematic Diagram and Circuit Board
Motorola No. PEPS-20971-C
9/1/80-UP

LOW VOLTAGE POWER SUPPLY

MODEL TPN1148A

Model Complement

MODEL	DESCRIPTION
TLN5122A	9.6 and 13.6 Volt Regulator Board
TRN6568A	Filament Regulator Board
TKN6703A	Cable, L.V. Power Supply
TKN6846A	Chassis Cable, L.V. Power Supply
TRN6569A	Chassis and Hardware Kit

1. DESCRIPTION

1.1 This power supply provides the following output voltages:

-- regulated 6.3 volts dc for PA tube filaments.

-- regulated 9.6 and 13.6 volts dc for operation of the solid-state circuitry contained within the transmitter.

-- unregulated 13.6 volts dc for the oscillator oven.

1.2 The low voltage power supply obtains its ac input from the companion high voltage power supply which provides a relatively constant input voltage (±3%) with a source voltage change of ±20%. Transistorized regulator circuits provide highly regulated dc output voltages.

2. THEORY OF OPERATION

2.1 INPUT CIRCUITRY (Refer to diagram PEPS-20976)

Diodes CR1 and CR2 provide full wave rectification of the nominal 14.5 volt ac input applied to TB1-6 and 7. The resulting dc voltage is applied through TB1-5 and fed through a double pi type LC filter to the 6.3 volt regulator on the filament regulator board, and to the 9.6 volt regulator. Diodes CR3 and CR4 provide full wave rectification of the nominal 18.5 volt ac input applied to TB1-2 and 3. The resulting dc voltage, applied through TB1-1, is capacitively filtered and applied to the 13.6 volt regulator. Each regulator circuit is protected from drawing excessive current by a fuse in its input.

2.2 9.6 V AND 13.6 V REGULATORS

2.2.1 General

Except for the voltages involved, the operation of the 9.6 volt and 13.6 volt regulators is the same. The operation of the 9.6 volt regulator is described in the following paragraphs (refer to diagram PEPS-20976).

2.2.2 9.6 V Regulator

2.2.2.1 Output

The 9.6 volt output is derived from a series regulator circuit that uses a higher level A+ as its source. An output voltage sensing circuit regulates the amount of current that is allowed to pass through the series regulator, thus controlling the voltage across the load.

2.2.2.2 Voltage Regulation

Transistors Q1, Q3, and Q4 form the voltage regulating circuit. Regulation is achieved by changing the amount of current to flow through the base of Q2. If the output voltage

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TRN6567A Chassis Kit (HV) PL-4416-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITORS ; fixed
[illegible]	8-84717G02	7 uF: ±6%: 660 V
[illegible]	8-82744H01	3-section: .12 uF: ±10%; 4400 V 1 uF: ±10%: 4400 V 1 uF: ±10%: 3600 V
[illegible]	[illegible]	2-section 125 uF: +100-10%: 100 V
		DIODES
CR1 thru CR4	[illegible]	silicon HV
CR10	[illegible]	silicon
[illegible]	[illegible]	silicon
		FUSE, cartridge
[illegible]	[illegible]	20A
[illegible]	[illegible]	.6A
		COIL
[illegible]	[illegible]	15H: ±10%
		RELAY
[illegible]	[illegible]0-82015H02	12 V
		RESISTORS, fixed; 10%
[illegible]		NOT USED
2, [illegible]	17-82906H01	75k: 75 W
[illegible]	6-82672B09	6.04 MEG: ±1%: 2 W
[illegible]	6-82672B08	47.5k ±1%: 1/2 W
[illegible]	6-125C73	10k: 1/2 W
[illegible]		NOT USED
[illegible]	6-126C17	47: 1 W
[illegible]	17-83027H03	1.5k: 3 W
[illegible]	17-82476B06	4 ±1%; 3 W
		TRANSFORMER, power: 95 to 145 V AC:
T1	25-84507F01	pri: BLK, BLK sec No. 1: RED, RED-BLU w/ RED-YEL center tap sec No. 2: RED-WHT, RED-WHT sec No. 3: BLU, BLU w/BLU-YEL center tap sec No. 4: YEL, YEL w/YEL-GRN center tap
		TRANSFORMER, power:
T2	25-82225H01	pri. BLK-WHT: 20 ohms dc resist. sec. GRN & GRN-YEL: 0.85 ohms dc resist. sec. RED & RED-YEL: 8.6 ohms dc resist.
	NON-REFERENCED ITEMS	
	1-80791B65	CIRCUIT BOARD ASSY, includes 1-80759B65 CIRCUIT BOARD and ref parts R10-R13
	2-7009	NUT: 10-32 x 3/8 x 1/8"; 4 req'd.
	3-3398	WASHER, tapping: 6-20 x 3/8"; 8 req'd.
	3-7506	SCREW, tapping: 6-20 x 1/4" 4 req'd.
	3-82907H01	ROD, threaded: 2 req'd.
	4-7658	WASHER, lock: #10 (split): 4 req'd.
	4-483357	WASHER, Insulating: 203"ID x .500"OD; 4 req'd.
	4-691959	WASHER, insulating: 4 req'd.
	7-82297H01	BRACKET, resistor: .940 x .940": 4 req'd.
	2-7002	NUT: 6-32 x 5/16 x 7/64": 4 req'd.
	2-115123	NUT: 10-32 x 3/8 x 1/8"; 2 req'd.
	2-119913	NUT: 8-32 x 11/32 x 1/8"; 6 req'd.
	2-121841	NUT: 6-32 x 5/16 x 7/64"; 6 req'd.
	3-7229	SCREW, machine: 6-32 x 3/8" 2 req'd.
	3-7297	SCREW, captive: 1/4-20 x 1/2" 4 req'd.
	3-115613	SCREW, machine: 4-40 x 1/4"; 4 req'd.
	3-122777	SCREW, machine: 8-32 x 1/2" 4 req'd.
	3-125541	SCREW, tapping: 6-20 x 1/4"; 4 req'd.
	3-134294	SCREW, tapping: 6-32 x 3/8"; 12 req'd.

TRN6566A Power Control Board PL-5112-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; unless otherwise stated
C52, 53	21-847087	220; 300 V
C54	21-82428B26	.02 +80-20%; 200 V
C55	23-83210A19	500 +100-10%; 20 V
C56	23-82783B17	2.2 ±20%; 20 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR54	48-82466H18	silicon
CR55, 56	48-82392B03	silicon
CR57	48-82466H18	silicon
CR58, 59, 60	48-82392B03	silicon
CR61	48-82466H18	silicon
		TRANSISTOR: (SEE NOTE)
Q52	48-869170	NPN; type M9170
Q53, 54	48-869293	NPN; type M9293
Q55, 56	48-869570	NPN; type M9570
Q57	48-869643	PNP; type M9643
		RESISTOR, fixed: ±10%; 1/4 W; unless otherwise stated
R54	6-124C75	12k
R55	6-124C57	2.2k
R56, 57	6-124C73	10k
R58	6-124C57	2.2k
R59	6-125A53	1.5k ±5%; 1/2 W
R60	6-124A71	8.2k ±5%
R61	6-125A31	180 ±5%; 1/2 W
R62	6-124C49	1k
R63	6-124C93	68k
R64, 65	6-124C59	2.7k
R66	6-124C69	6.8k
R67	6-124C61	3.3k
R68	6-124C33	220
R69	6-124C73	10k
R70	6-124C75	12k
R71	6-124C73	10k
R72	6-124C65	4.7k
R73	6-124C57	2.2k
R74	6-127C35	270; 2 W
R75	6-124C35	270

NOTE: For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

TKN6840A Cable Kit (H.V.) PL-5113-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, receptacle: includes:
J9	14-83783A01	INSULATOR, 18-circuit
	29-82335A01	TERMINAL, male: 2 used
	29-82336A01	TERMINAL, female: 11 used
J10	29-10134A59	lug, chain-form (crimp type)
	NON-REFERENCED ITEMS	
	29-847854	LUG, slotted-tongue: 4 used
	42-10217A02	STRAP, cable harness: 15 used

increases, the Q2 base current is decreased, and vice versa. The regulator output voltage is developed across R8 and R9. The voltage developed across R9 reflects all fluctuations of the output load voltage and is applied to the base of Q4. Since the emitter of Q4 is held to 8.2 volts by Zener diode VR1, Q4 conducts in response to the output load voltage fluctuations. When the output load voltage is 9.6 volts, Q4 conducts at a specific level which fixes its collector voltage to a specific level. This voltage level determines the drive to the base of Q3, which determines the drive to the base of Q2. Q1 is a constant current source for the collector of Q4 and the base of Q3. Current through Q1 is held constant because of the voltage drop across CR5 and CR6 which maintains a constant base to emitter bias voltage.

If the 9.6 volt output increases, the Q4 base voltage increases and Q4 conducts harder which causes its collector voltage to decrease. This causes Q3 to conduct less and Q3 collector to draw less current. This decreases the amount of base current Q2 can draw, thus causing the emitter to collector impedance across Q2 to increase. The voltage dropped across Q2 increases, decreasing the output load voltage to normal. If the 9.6 volt output decreases, the above action reverses to bring the output voltage back up to the normal level. For the 9.6 volt regulator, the output voltage may range between 9.0 and 10.2 volts dc. For the 13.6 volt regulator, the output voltage may range between 12.9 and 14.5 volts dc.

2.3 FILAMENT REGULATOR CIRCUIT

The 6.3 volt filament regulator operates in a manner similar to that described for the 9.6 and 13.6 volt regulators (refer to diagram PEPS-20980). This regulator uses an additional amplifier transistor (Q52) to increase the drive voltage available to driver stage Q53. In addition, Q53 is changed to a collector follower instead of an emitter follower. This reduces the minimum voltage drop permitted across series pass stage Q54. Q55 operates as a reference amplifier for the regulating circuitry and its operating point is adjustable by filament voltage control R59.

The 6.3 volt filament regulator employs a filament voltage control to protect the filament during transmission. R59 and R60 provide a voltage divider network used to set the filament voltage. Under unkeyed conditions, the filament control input (from the high voltage power supply) is high, turning Q56 on and removing R60 from the circuit. With Q56 on, the drive to Q55 through R59 is reduced, pulling the collector of Q55 high and increasing the filament voltage to 6.3 volts. When the transmitter is keyed, the filament control input goes low, turning Q56 off. The high impedance of Q56 collector places R60 in the circuit. R60 may now be set to increase the drive to Q55, lowering its collector voltage and reducing the filament voltage to approximately 5.0 volts.

The filament control input also controls the bias output control. A low input (transmitter keyed) will turn on Q57, providing approximately 10 volts at the bias output control.

2.4 TRANSMITTER INHIBIT CIRCUIT

Upon initial turn-on, the transmitter inhibit circuit disables the transmitter for approximately 68 seconds, allowing the tube filaments in the final power amplifier to warm up (refer to diagram PEPS-20980).

When power is applied to the station, three things happen:

-- 60 Hz signal is applied to IC52A.

-- The counter is reset (pin 11) and output pin 2 goes to logic 0.

-- The 6.3 volt output from the filament regulator board is inverted (Q58) and applied to pins 12 and 13 on IC52D.

The high output from IC52D is fed to IC52C and IC52B, and the high output from IC52B fed back to IC52A. IC51 is now enabled and will count for approximately 68 seconds. When the counter output goes high, the output to IC52B goes low. This low is fed back to pin 1 on IC52A, locking the counter in this state. The high counter output is also fed to IC52C. The resulting low turns Q60 off, enabling the transmitter.

C62 provides a spike pulse to reset the counter when power is initially applied. C63 provides transient protection for the low power CMOS logic chips.

NOTE

Low power CMOS chips are used. Consult 68P81106E64 before starting repair or maintenance procedures.

3. MAINTENANCE

Isolate malfunctions of this power supply following conventional troubleshooting procedures.

Note that the ac input voltages to the power supply are not sinusoidal and, thus, cannot be measured with a standard ac voltmeter. All voltage checks must be made where dc voltages are present.

CAUTION

Turn the power to the station off and allow time for the capacitors to discharge through their bleeder resistors before attempting to replace components or repair this power supply.

4. FILAMENT VOLTAGE ADJUSTMENT

The filament voltage MUST be readjusted whenever the power amplifier tube is replaced. To make the adjustment, two controls are set while monitoring the filament voltage at the output terminals with a voltmeter. Proceed as follows:

Step 1. Turn on the power to the station and make sure that all interlock switches are closed.

Step 2. Set filament voltage control R59 on the filament regulator board to its midpoint position. Allow the power amplifier tube filaments to warm-up and stabilize for a minimum of two minutes.

Step 3. Connect the VOM across the 6.3 volt output terminals. Set R59 to obtain 6.3 volts. Allow voltage to stabilize for one minute. Repeat until voltage stabilizes.

Step 4. With the VOM still connected across the 6.3 volt output, key the transmitter.

Step 5. Set R60 to obtain a 5 volt reading on the VOM.

REF
SY

PAR

TRN65

C2 th
C12
C18
C21
C55

CR1,
CR3,

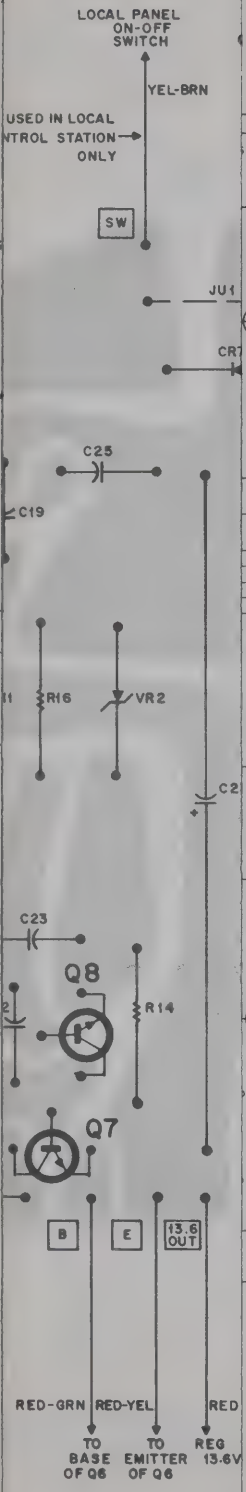
F2, 3
F51

L1, 2

Q2, 6,

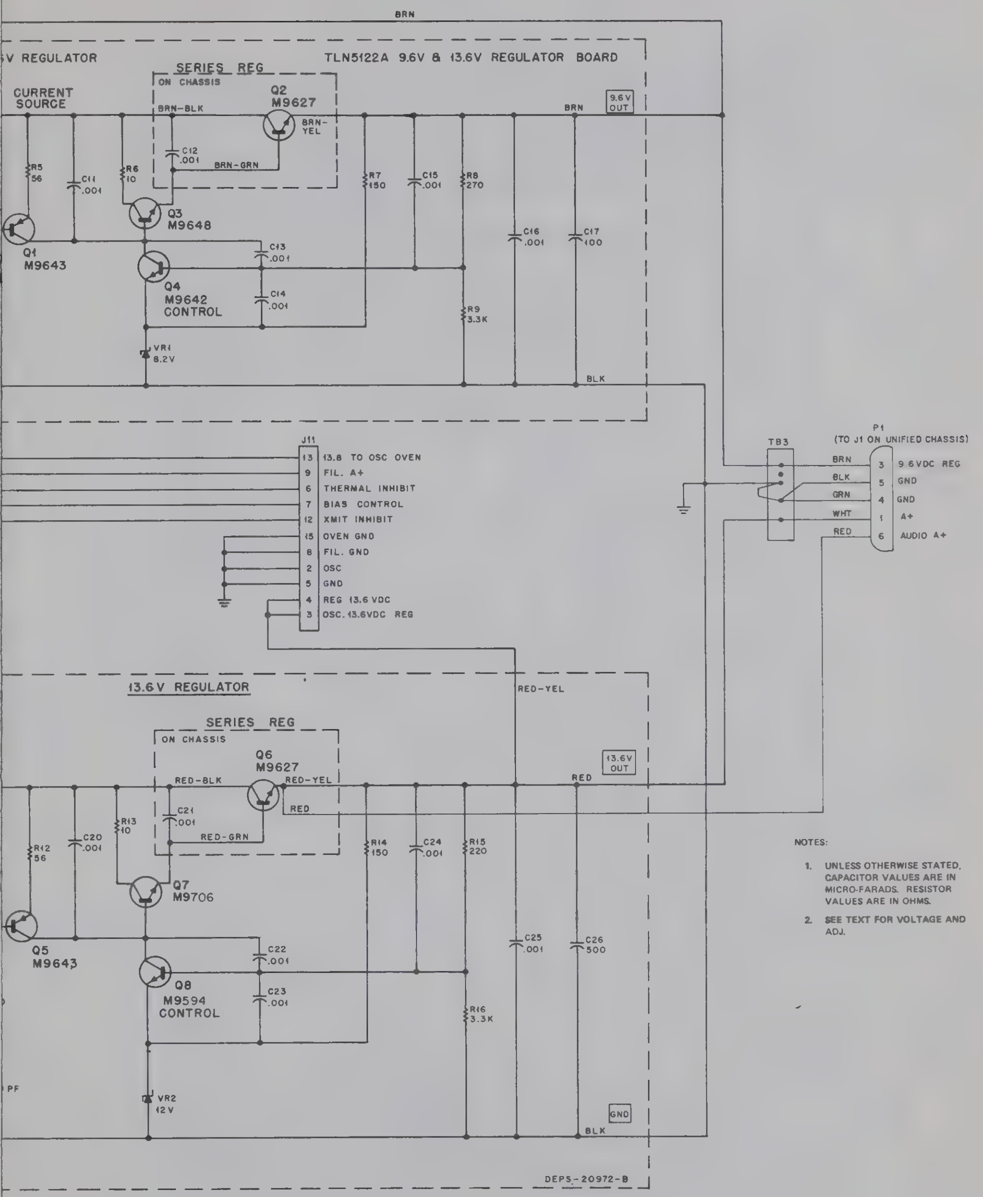
R1, 2
R20

TB1
TB2


LOCAL PANEL ON-OFF SWITCH
YEL-BRN
USED IN LOCAL
NTROL STATION
ONLY
SW
JU1
CR7
C25
C19
R16
VR2
C2
C23
Q8
R14
Q7
B
E
13.6 OUT
RED-GRN
RED-YEL
RED
TO BASE OF Q6
TO EMITTER OF Q6
REG 13.6V

SHOWN FROM

9.6V AND 13.6V


BRN
V REGULATOR
TLN5122A 9.6V & 13.6V REGULATOR BOARD
SERIES REG
ON CHASSIS
CURRENT SOURCE
Q2 M9627
BRN-BLK
BRN-YEL
9.6V OUT
C12 .001
BRN-GRN
R5 56
C11 .001
R6 10
Q3 M9648
R7 150
C15 .001
R8 270
Q1 M9643
C13 .001
Q4 M9642 CONTROL
C14 .001
C16 .001
C17 100
R9 3.3K
VR1 8.2V
BLK
J11
13.8 TO OSC OVEN
FIL. A+
THERMAL INHIBIT
BIAS CONTROL
XMIT INHIBIT
OVEN GND
FIL. GND
OSC
GND
REG 13.6 VDC
OSC. 13.6VDC REG
TB3
P1 (TO J1 ON UNIFIED CHASSIS)
BRN
BLK
GRN
WHT
RED
9.6VDC REG
GND
GND
A+
AUDIO A+
13.6V REGULATOR
RED-YEL
SERIES REG
ON CHASSIS
Q6 M9627
RED-BLK
RED-YEL
RED
13.6V OUT
C21 .001
RED-GRN
R13 10
R12 56
C20 .001
R14 150
C24 .001
R15 220
Q7 M9706
Q5 M9643
C22 .001
Q8 M9594 CONTROL
C23 .001
C25 .001
C26 500
R16 3.3K
VR2 12V
GND
BLK
DEPS-20972-B

NOTES:

1. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN MICRO-FARADS. RESISTOR VALUES ARE IN OHMS.
2. SEE TEXT FOR VOLTAGE AND ADJ.

TLN5122A 9.6 and 13.6 V Regulator Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-20976-C
9/1/80-UP

PARTS LIST

TRN6569A Chassis and Hardware PL-4425-B

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF ±10%, 100 V, unless otherwise stated
[illegible]	23-83093G20	17500 +150-10%, 20 V
[illegible]	21-82187B14	.001
[illegible]	23-82304B16	5000 +150-10%; 35 V
[illegible]	21-82187B14	.001
[illegible]	21-82187B14	.001
		SEMICONDUCTOR DEVICE, diode. (SEE NOTE)
[illegible]	1-80739B59	silicon
CR3, 4	48-62525G13	silicon
		FUSE, cartridge
F2, 3	65-61668	4A; 250 V
F51	15-817956	5A; 250 V
		COIL, choke:
L1, 2	25-84514G01	250 uH
		TRANSISTOR: (SEE NOTE)
Q2, 6, 54	48-869627	NPN type M9627
		RESISTOR, fixed.
R1, 2	17-83389G02	30 ±5%, 20 W
R20	17-861376	1 ±10%, 25 W
		TERMINAL BOARD:
TB1	31-82596E02	7-terminal
TB2	31-50378	2-terminal
	NON-REFERENCED ITEMS	
	1-80785B74	CHASSIS ASSEMBLY Includes
	9-84935D01	SOCKET, transistor: 3 req'd.
	27-84135G02	CHASSIS, power supply
	31-118964	TERMINAL STRIP: 5-lug
	31-120365	TERMINAL STRIP: 3-lug
	64-850015	PLATE, capacitor mounting: 9 req'd
	2-7007	NUT 8-32 x 1/4 x 3/32, 2 req'd.
	2-119913	LOCKNUT: 8-32 x 11/32 x 1/8", 3 req'd.
	2-135435	NUT: 1/4-20 x 7/16 x 5/32"
	3-114933	SCREW, machine: 8-32 x 1-1/4": 2 req'd.
	3-122777	SCREW, machine: 8-32 x 1/2" 2 req'd.
	3-125913	SCREW, tapping: 6-18 x 1/2" 6 req'd.
	3-127914	SCREW, tapping: 6-32 x 1/4" 4 req'd.
	3-136146	SCREW, tapping: 8-32 x 5/8" 6 req'd.
	3-139147	SCREW, tapping: 8-18 x 5/8 4 req'd.
	3-410095	SCREW, machine: 1/4-20 x 5 8
	3-488100	SCREW, machine: 6-32 x 1-1/4": 4 req'd.
	4-7651	WASHER, lock: #8 (split): 4 req'd
	4-7666	WASHER, lock: #6 (split): 6 req'd.
	4-7670	WASHER, lock: #1/4 (internal tooth)
	14-865854	INSULATOR, transistor: 3 req'd.
	14-84548A01	WASHER, insulating: 2 req'd.
	29-134176	LUG, soldering: (.250): 2 req'd.
	29-835302	LUG, ring tongue: #1/4: 2 req'd.
	29-845081	LUG, ring tongue: #3/8: 2 req'd.
	29-847854	LUG, slotted tongue: #6: 5 req'd.
	29-859665	LUG, ring tongue
	42-10217A02	STRAP, cable harness: 4 req'd.
	43-864364	SPACER, threaded: 4 req'd.
	43-83620H01	SPACER, .940" lg.: 4 req'd.
	43-84510G01	SPACER: .40" lg.: 4 req'd.
	7-82037L01	BRACKET, connector
	3-122316	SCREW, machine: 8-32 x 2-1/2"
	4-852296	WASHER, shoulder: 2 req'd.
	4-7657	WASHER, lock: #8 (external tooth)
	4-7582	WASHER, flat: .195 x .500 x .033"

TKN6703A Cable, Low Voltage Power Supply

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
	9-84151B03	CONTACT, receptacle: [illegible]
	14-84590B01	[illegible]SULATOR, connector
	42-10217A02	STRAP, cable: 11 req'd

N6846A Cable Assembly PL-4426-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CONNECTOR, receptacle: includes:
	14-82836H01	HOUSING, connector (15-contact)
	29-82336A01	CONTACT, female: 11 req'd.
	NON-REFERENCED ITEMS	
	847854	LUG, slotted tongue: 5 req'd.
	29-859665	LUG, ring tongue: 3 req'd.
	42-10217A02	STRAP, cable harness: 11 req'd.

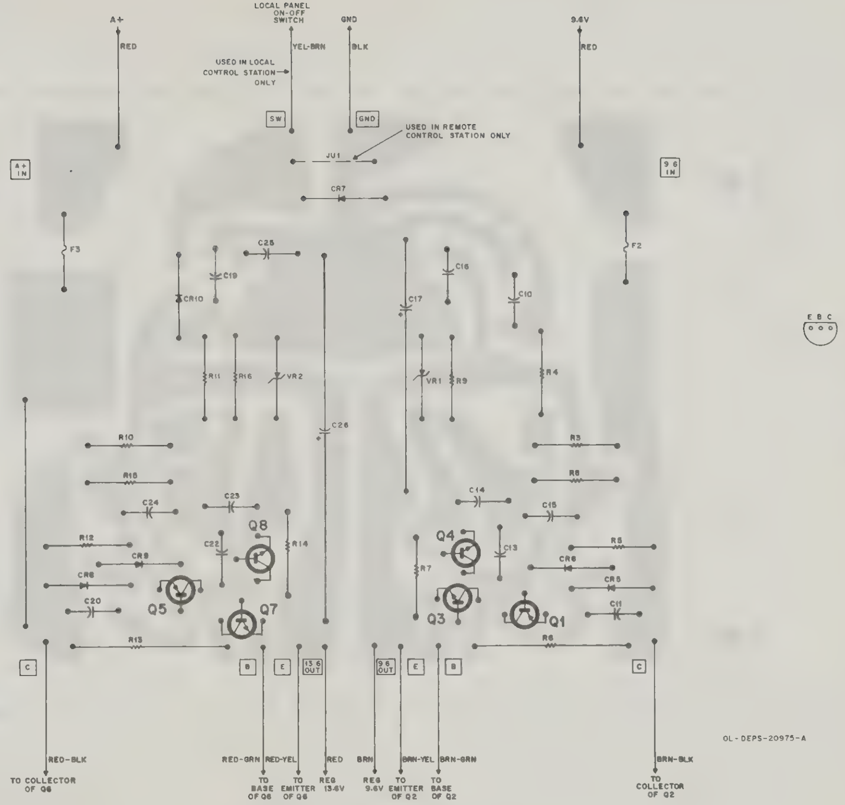
REVISIONS

PEPS-20976-B

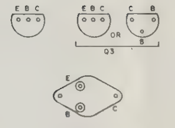
CHASSIS AND SUFFIX NO	REF SYMBOL	CHANGE	LOCATION
TLN5122A-1		FROM 48-869648, M9648 TO 48-869706, M9706	13.6 V SERIES REGULATOR
		FROM 48-869642, M9642 TO 48-869594, M9594	

TLN5122A Regulator Board PL-4424-A

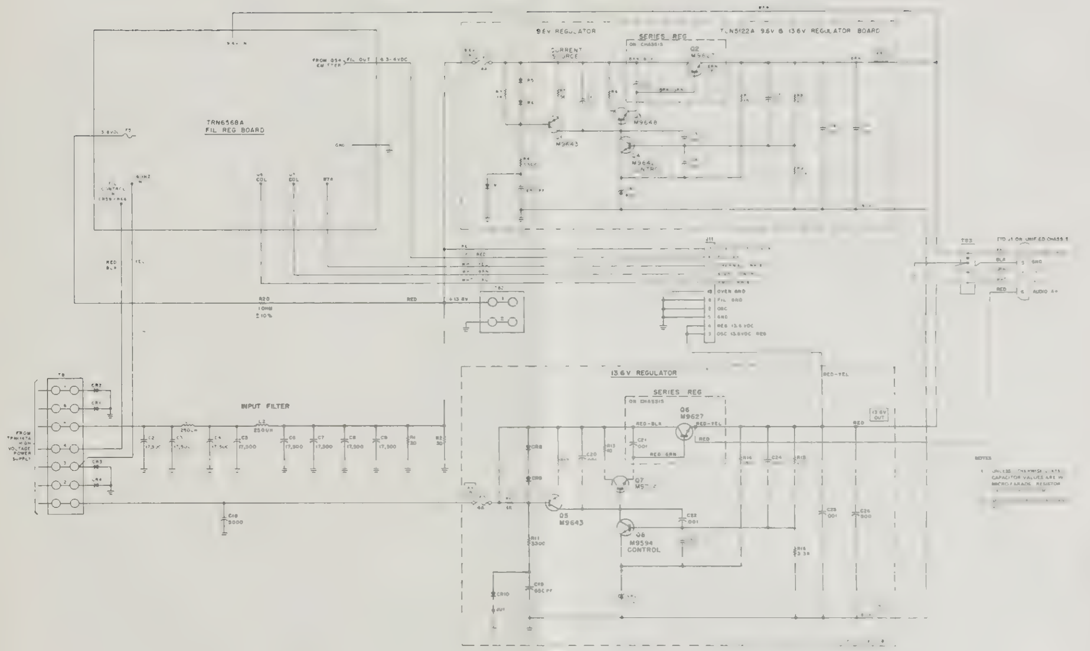
REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF ±10%, 100 V unless otherwise stated
C10	21-848236	650 pF ±5%; 300 V
C11	21-82187B20	.001
C13 thru 16	21-82187B20	.001
C17	23-82601A25	100, -10+150%; 20 V
C19	21-848236	650 pF ±5%; 300 V
C20	21-82187B20	.001
C22 thru 25	21-82187B20	.001
C26	23-83210A19	500, -10+100%; 20 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR5 thru 10	48-83654H01	Silicon
		TRANSISTOR: (SEE NOTE)
Q1	48-869643	PNP; type M9643
Q3	48-869648	NPN; type M9648
Q4	48-869642	NPN; type M9642
Q5	48-869643	PNP; type M9643
Q7	48-869706	NPN; type M9706
Q8	48-869594	NPN; type M9594
		RESISTOR, fixed: ±10%; 1/4 W unless otherwise stated
R3	6-124C49	1k
R4	6-124C61	3.3k
R5	6-124C19	56
R6	6-126C01	10, 1 W
R7	6-124C29	150
R8	6-124A35	270 ±5%
R9	6-124A61	3.3k ±5%
R10	6-124C47	1k
R11	6-124C49	3.3k
R12	6-124C19	56
R13	6-126C01	10, 1 W
R14	6-124C29	150
R15	6-124A33	220 ±5%
R16	6-124C61	3.3k ±5%
		SEMICONDUCTOR DEVICE, (SEE NOTE)
VR1	48-82256C08	Zener, 8.2 V
VR2	48-82256C25	Zener, 12 V
	NON-REFERENCED ITEM	
	42-82690A01	CLIP, fuse; 4 req'd.


A+
RED
LOCAL PANEL ON-OFF SWITCH
YEL-BRN
GND
BLK
9.6V
RED
USED IN LOCAL CONTROL STATION ONLY
USED IN REMOTE CONTROL STATION ONLY
SW
GND
JU1
CR7
A+ IN
9.6 IN
F3
F2
C25
C19
C18
C16
C17
C10
CR10
R11
R16
VR2
VR1
R9
R4
C26
R10
R3
R15
R8
C24
C23
C14
C15
R12
C22
R14
Q8
Q4
C13
R5
CR9
R7
CR6
CR8
CR5
Q5
Q7
Q3
Q1
C20
C11
R13
R6
C
B
E
13.6 OUT
9.6 OUT
RED-BLK
RED-GRN
RED-YEL
RED
BRN
BRN-YEL
BRN-GRN
BRN-BLK
TO COLLECTOR OF Q8
TO BASE OF Q8
TO EMITTER OF Q8
REG 13.6V
REG 9.6V
TO EMITTER OF Q2
TO BASE OF Q2
TO COLLECTOR OF Q2
OL-DEPS-20975-A

SHOWN FROM COMPONENT SIDE
9.6V AND 13.6V REGULATOR BOARD

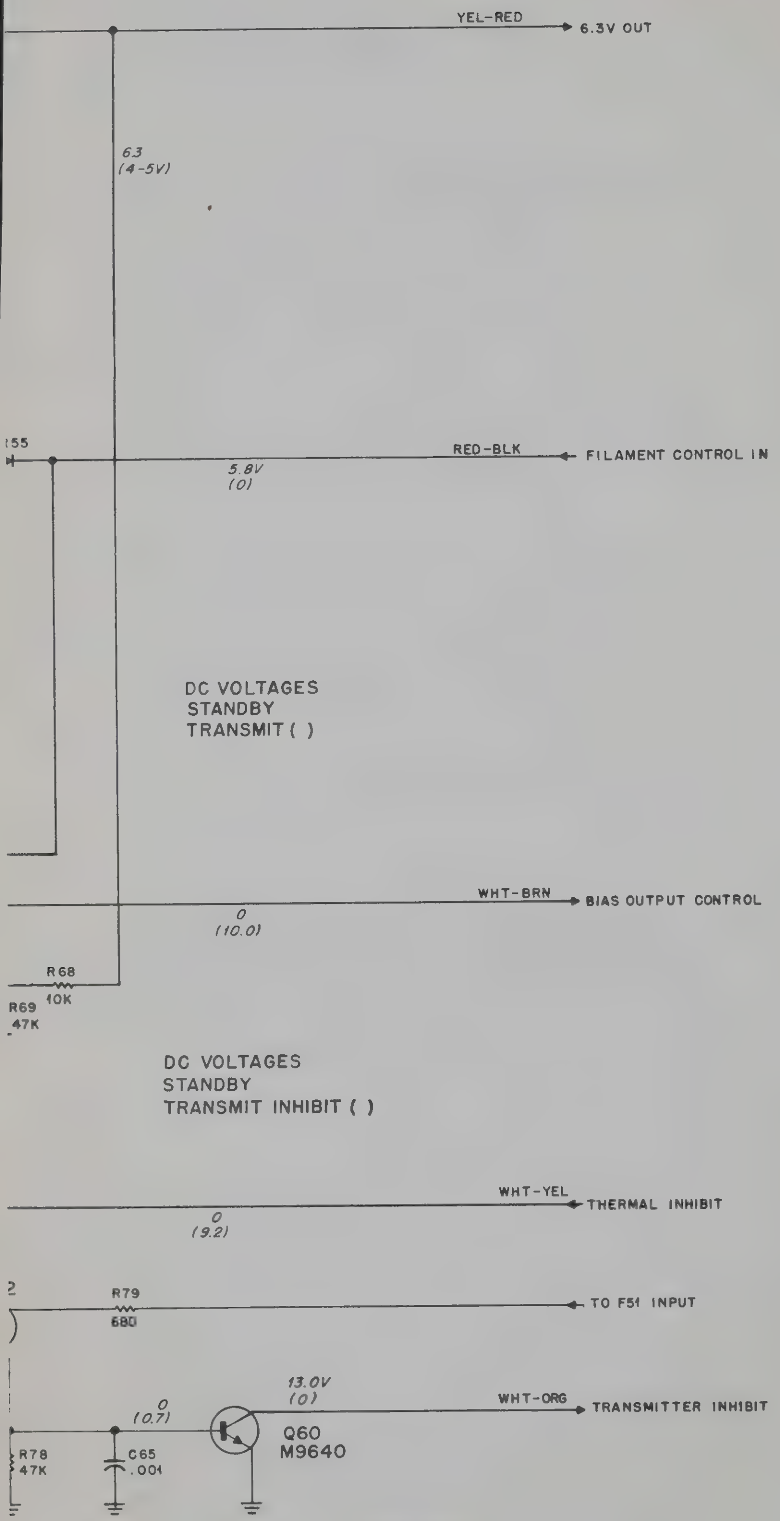

E B C
E B C
OR
C B
Q3
E
B
C

BASE DETAILS (PIN SIDE)


TRN6569A P/L REG BOARD
9.6 V REGULATOR
SERIES REG
TLN5122A 9.6V & 13.6V REGULATOR BOARD
INPUT FILTER
13.6 V REGULATOR
SERIES REG
Q4 M9642
Q5 M9643
Q8 M9594
Q3 M9648
Q1 M9643
Q2 M9627 CONTROL
C22 .001
C25 .001
C26 500
R16 3.3k

TLN5122A 9.6 and 13.6 V Regulator Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-20976-C
9/1/80-LP

LOW VOLTAGE POWER SUPPLY


YEL-RED
6.3V OUT
6.3
(4-5V)
155
RED-BLK
FILAMENT CONTROL IN
5.8V
(0)
WHT-BRN
BIAS OUTPUT CONTROL
0
(10.0)
R68
10K
R69
47K
WHT-YEL
THERMAL INHIBIT
0
(9.2)
2
R79
680
TO F51 INPUT
13.0V
(0)
WHT-ORG
TRANSMITTER INHIBIT
0
(0.7)
Q60
M9640
R78
47K
C65
.001

DC VOLTAGES
STANDBY
TRANSMIT ( )

DC VOLTAGES
STANDBY
TRANSMIT INHIBIT ( )

DEPS-20977-0

MOTOROLA

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SCHEMATIC DIAGRAMS AND CABLING DIAGRAMS

1. ☐ Are accurate and easy to follow
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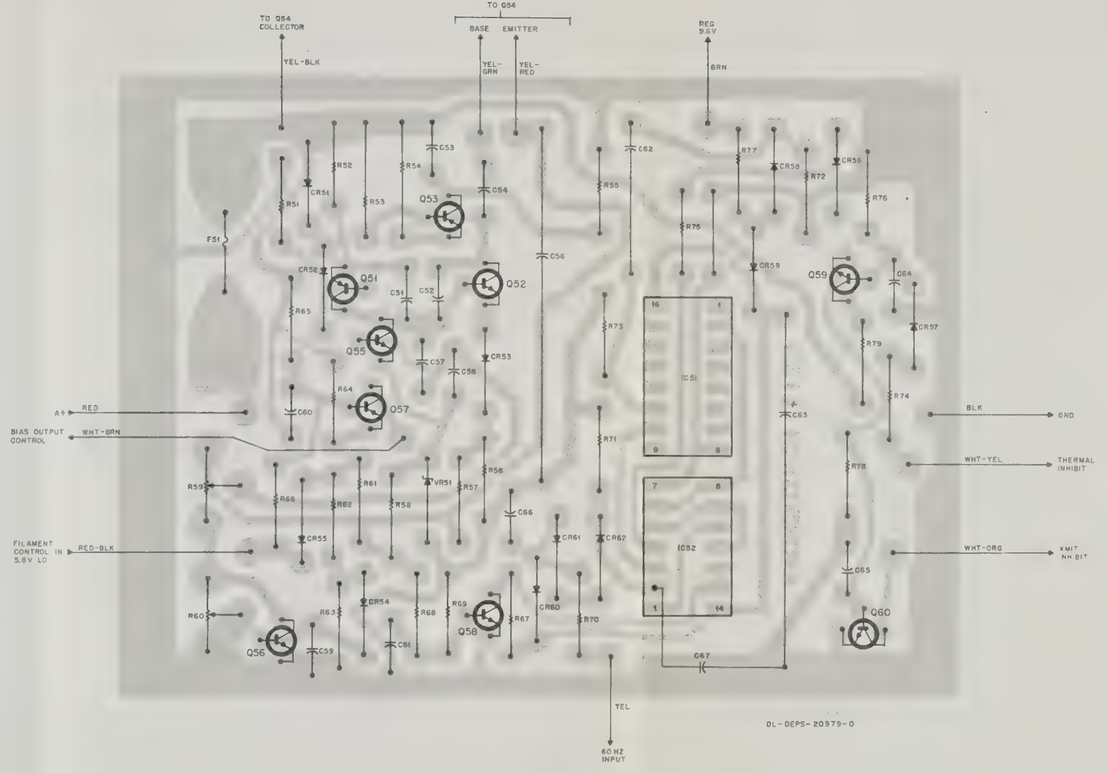
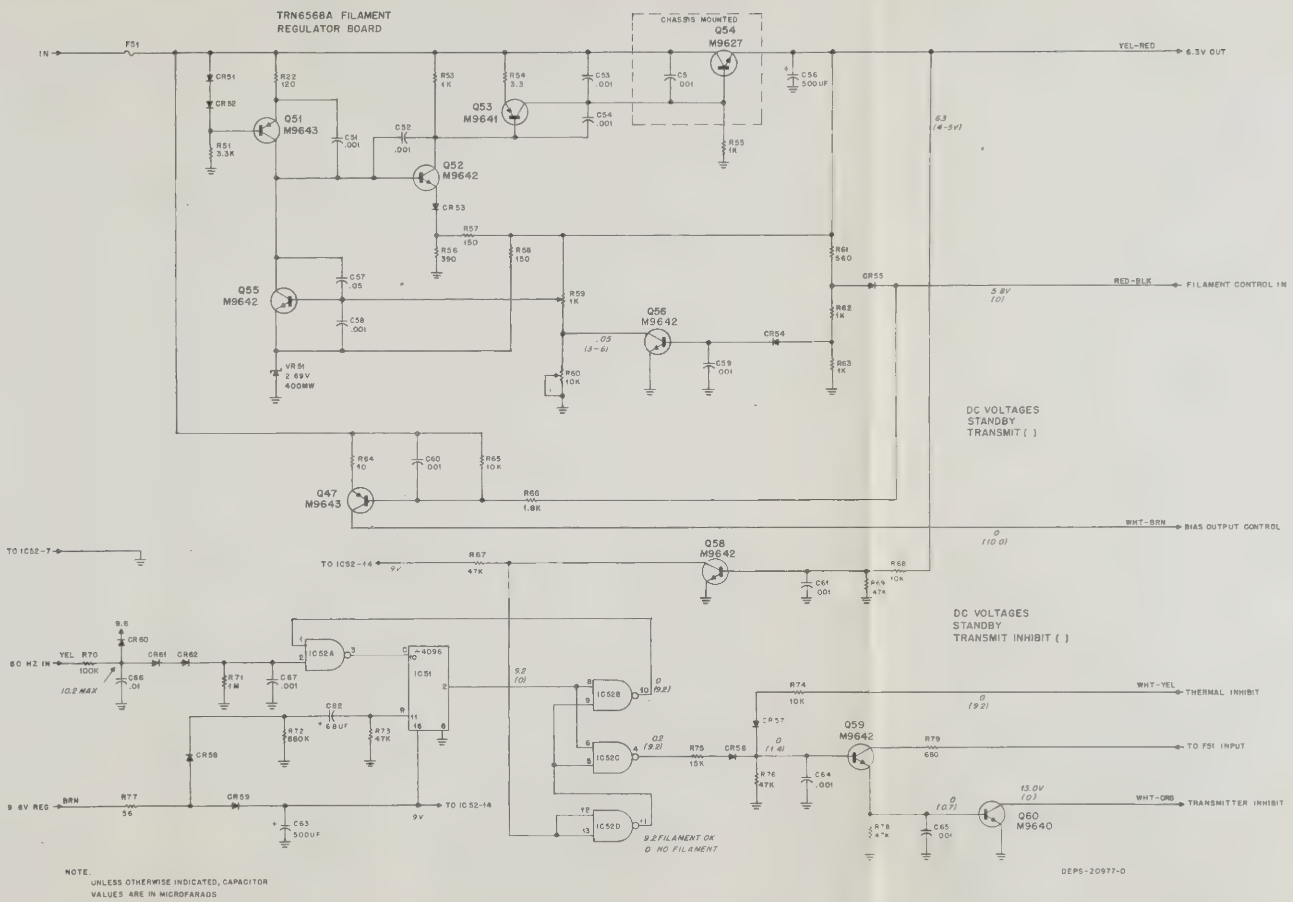
PARTS LIST

TRN6568A Filament Regulator Board PL-4423-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF ±[illegible] [illegible] unless otherwise stated
C51 thru 54	21-82187B20	.001
C56	23-83210A19	500 ±10%; 20 V
C57	21-82372C07	.05 +80-20%; 25 V
C58 thru 61	21-82187B20	.001
C62	23-83214C05	6.8 ±20%; 15 V
C63	23-83210A19	500; 20 V
C64, 65	21-82187B20	.001
C66	21-832501	.01 uF
C67	21-82187B20	.001 uF; 100 V
		DIODE: (SEE NOTE)
CR51 thru 62	48-83654H01	silicon
		FUSE, cartridge:
F51		[illegible] Amp., 250 V
		INTEGRATED CIRCUIT: (SEE NOTE)
IC51	51-84887K12	MC14020BCP
IC52	51-84887K64	MC14093CP
		RESISTORS, fixed, 10% 1/4 W,
R51	6-124C61	3.3k
R52	6-124C27	120
R53	6-124C49	1k
R54	6-125B57	3.3; ±5%; 1/2 W
R55	6-124C49	1k
R56	6-124C39	390
R57, 58	6-124C29	150
R59	18-83083G[illegible]	variable; 1k
R60	18-83083G10	variable; 10k
R61	6-124C43	560
R62, R63	6-124C49	1k
R64	6-124C01	10
R65	6-124C73	10k
R66	6-124C55	1.8k
R67	6-124C89	47k
R68	6-124C73	10k
R69	6-124C89	47k
R70	6-124C97	100k
R71	6-124C22	1 MEG
R72	6-124B18	680k; ±5%
R73	6-124C89	47k
R74	6-124C73	10k
R75	6-124C77	15k
R76	6-124C89	47k
R77	6-124C19	56
R78	6-124C89	47k



TO Q54 COLLECTOR
YEL-BLK
TO Q54
BASE
EMITTER
YEL-GRN
YEL-RED
REG 9.6V
BRN
A+
RED
BIAS OUTPUT CONTROL
WHT-BRN
FILAMENT CONTROL IN 5.8V LO
RED-BLK
BLK
GND
WHT-YEL
THERMAL INHIBIT
WHT-ORG
XMIT INHIBIT
YEL
60 HZ INPUT
F51
Q51
Q52
Q53
Q55
Q56
Q57
Q58
Q59
Q60
IC51
IC52
OL-DEPS-20979-0



TRN6568A FILAMENT REGULATOR BOARD
IN
F51
CHASSIS MOUNTED
Q54 M9627
C56 500UF
YEL-RED
6.3V OUT
Q51 M9643
Q52 M9642
Q53 M9641
Q55 M9642
Q56 M9642
Q47 M9643
Q58 M9642
Q59 M9642
Q60 M9640
VR51 2.69V 400MW
63 (4-5V)
RED-BLK
FILAMENT CONTROL IN
5.8V (0)
WHT-BRN
BIAS OUTPUT CONTROL
0 (10.0)
DC VOLTAGES
STANDBY
TRANSMIT ( )
TO IC52-7
TO IC52-14
9V
60 HZ IN
YEL
10.2 MAX
9.6V REG
BRN
IC52A
IC51
÷4096
IC52B
IC52C
IC52D
TO IC52-14
9.2 FILAMENT OK
0 NO FILAMENT
DC VOLTAGES
STANDBY
TRANSMIT INHIBIT ( )
WHT-YEL
THERMAL INHIBIT
TO F51 INPUT
WHT-ORG
TRANSMITTER INHIBIT
13.0V (0)
DEPS-20977-0

NOTE
UNLESS OTHERWISE INDICATED, CAPACITOR VALUES ARE IN MICROFARADS

TRN6568A Filament Regulator Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-20980-A
3/30/78-LP

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3. ☐ Contain major errors
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Check item desired:

☐	**Basic Logic Circuit Guide** Describes the basic logic circuits used in Motorola Communications digital equipment and the logic notational scheme used in our instruction manuals.	68P81105E88
☐	**"Digital Private-Line" Binary-Coded Squelch** Contains fundamentals of "Digital Private-Line" system operation, circuit operation and servicing techniques.	68P81106E83
☐	**Safe Handling of CMOS Integrated Circuit Devices** Describes special handling techniques needed to prevent irrepairable damage from static charges encountered with normal handling of CMOS devices.	68P81106E84
☐	**Reducing Noise Interference in Mobile Two- Way Radio Installations** Defines the major sources of noise encountered in a mobile radio installation and suggests methods of remedying them.	68P81109E33
☐	**Anti-Skid Braking Precautions** Provides installation suggestions and a detailed checkout procedure for installation of mobile radios in vehicles with anti-skid braking systems.	68P81109E34

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